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Engagement in Learning Communities

INCOSE IS 2023
PPI's takeaways and insights

WELCOME

Welcome to the latest edition of our Systems Engineering Newsjournal, where we delve into the evolving landscape of systems engineering. This issue's theme, "Engagement in Learning Communities," underscores the power of collaborative learning to drive innovation and advancement in the SE field.

In this month's edition, join us in celebrating the achievements of trailblazers in the System Dynamics community as we spotlight award winners at the International System Dynamics Conference (ISDC). In addition, learn about the digital twin architectural framework, published by the Digital Twin Consortium (DTC). This framework is dedicated to achieve scalability, interoperability, and composability in digital architectures. Stay ahead of the curve and learn about the NIST Cybersecurity Framework 2.0 as well as find out how to participate in the INCOSE 2023 Election Ballot. Your voice matters, and your say will shape the leadership of this major SE society in coming years. Read about all of the above and much more in the SE news section!

In 'Conferences, Webinars and Meetings', you can explore a multitude of upcoming events geared for the systems engineering community. From IEEE Requirements Engineering to the World Agility Forum, there's something of interest for everyone. Furthermore, in our feature article for the month, we present "PPI Reflections on INCOSE IS 2023," that comprises unique perspectives on this seminal event, as provided by key PPI members. Do you agree with our reflections or have different insights to share? We would really like to hear from you.

It wouldn't be a PPI SyEN edition without handy SE-related resources. NAFEMS is offering a series of e-Learning courses from September to November covering a diverse range of topics related to simulation, engineering, and analysis. Learn about the International Institute of Business Analysis (IIBA) open-access library of Business Analysis Live! Here listeners can gain valuable perspectives and actionable insights to drive better business outcomes. Whether through online courses, information repositories, informative podcasts, or cutting-edge initiatives – gain access to some high value resources in this section. As always, Syenna has some words to reflect in her closing remarks.

We invite you to not only engage with the content but also to actively contribute your thoughts, experiences, and expertise. Share your thoughts via ppisyen@ppi-int.com. Our community thrives on collaboration, and your inputs play a pivotal role influencing future topics of discussion. Enjoy this August 2023 edition! Happy reading.

Warm regards,

René

Managing Editor, PPI SyEN

Views expressed in externally authored articles are not necessarily the views of PPI nor of its professional staff.

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PPI Systems Engineering Newsjournal (PPI SyEN) seeks:

➢ To advance the practice and perceived value of systems engineering across a broad range of activities, responsibilities, and job-descriptions

➢ To influence the field of systems engineering from an independent perspective

➢ To provide information, tools, techniques, and other value to a wide spectrum of practitioners, from the experienced, to the newcomer, to the curious

➢ To emphasize that systems engineering exists within the context of (and should be contributory toward) larger social/enterprise systems, not just an end within itself

➢ To give back to the Systems Engineering community

PPI defines systems engineering as:
an approach to the engineering of systems, based on systems thinking, that aims to transform a need for a solution into an actual solution that meets imperatives and maximizes effectiveness on a whole-of-life basis, in accordance with the values of the stakeholders whom the solution is to serve. Systems engineering embraces both technical and management dimensions of problem definition and problem solving.

SYSTEMS ENGINEERING NEWS

Recent events and updates in the field of systems engineering

International System Dynamics Conference (ISDC 2023) Awards

At the 2023 International System Dynamics Conference (ISDC 2023) that was held on 23-27 July in Chicago, Illinois, USA, the System Dynamics Society (SDS) announced a range of awards to organizations and individuals who have contributed to the theory and application of system dynamics and to the advancement of the Society.

The **System Dynamics Applications Award** is presented by the Society as often as every year for the best "real world" application of System Dynamics. *ReThink Health* won this award for its development of the ReThink Health System Dynamics model which has enabled real-world initiatives in the health sector. The model is being used by more than 20 universities, with more than 2000 people having joined its network, and 52 federal agencies collaborating together on long-term plans for equitable recovery and resilience based on the System Dynamics work.

The **Outstanding Service Award** recognizes individuals that have, on a volunteer basis, made exceptional contributions to the Society over an extended period. *Rod MacDonald* received this award at ISDC 2023. MacDonald has over 25 years of experience developing simulation models as decision-support tools for local, state, and federal agencies and numerous businesses. A seasoned instructor at the Summer School, Rod has also been a co-leader for the Modeling Assistance Workshop during conferences, an initiative that has since evolved into the year-round Short-Term Modeling Assistance program.

The **Dana Meadows Award**, recognizing the very best student work in the field, was given to *Ann Osi* for the paper, co-authored with Navid Ghaffarzadegan, titled, "*Data-informed parameter estimation in behavioral epidemic models*".

Samuel Allen and Andrada Tomoaia-Cotisel received the **Early Career Health Paper Award** for their paper, "*Implementing and Sustaining Healthcare Quality Improvement: A Case Study Examining Feedback Structure and Dynamics*". This award recognizes outstanding papers dealing with health-related topics, authored by students or recent graduates.

Additional awards included:

- Barry Richmond Scholarship Award, given to *Junlai Zhang* for the paper, *"Using System Dynamics modeling to forecast China's population until 2060 to visualize the aging and shrinking population trends".*
- Honorable Mention for both the Dana Meadows and Health Award to *Zeynep Hasgul and Alireza Akhavan* for the paper, "*Health-related Quality of Life of Patients Receiving Immunotherapy: Modeling Analysis (Q-PRIMA Study)*".
- Honorable Mention for the Dana Meadows Award to *Rachel Thompson* for the paper, "*A qualitative system dynamics model of overdose bystander behavior in the context of Connecticut's Good Samaritan Laws*".
- Honorable Mention for the Health Award to *Nabeela Mumtaz* for the paper, "*Estimates of the Reproduction Number for Seasonal Influenza Infectious Disease in the European Region from 2012 to 2016*".
- Honorable Mention for the Dana Meadows Award to *Zahra Shams Esfandabadi for the paper,*

"The Future of Carsharing Services and its Role in Sustainable Transportation".

Learn more about SDS awards, past and present.

ISDC 2023 conference recordings for these and other papers, presentations and sessions are available through 30 September for those who register here.

PPI SyEN congratulates these award recipients for their contributions to the field of System Dynamics.

Digital Twin Platform Stack Architectural Framework

The Digital Twin Consortium (DTC) has announced the publication of a new whitepaper, "*Platform Stack Architectural Framework: An Introductory Guide*". The 49-page guide, a product of the DTC's Open Source, Standards and Platform Stacks Subgroup, presents best practices for the design and architecting of digital twin systems in order to achieve scalability, interoperability, and composability. The guide provides foundational understanding of digital twin architecture practices including:

- Central concepts of a digital twin system.
- Elements that take a solution from being a great model or simulation to qualifying as a digital twin.
- Reference architecture with foundational building blocks.
- Digital twin use cases.
- Review of some commonly adopted technological approaches and standards.
- Common framework elements of digital twin systems.

Download the guide.

Learn more about the Digital Twin Consortium here.

Draft NIST Cybersecurity Framework 2.0 & Implementation Examples

The U.S. National Instititute for Standards and Technology (NIST) released the public draft of the NIST Cybersecurity Framework (CSF) 2.0 on 8 August 2023. The CSF 2.0 provides guidance to industry, government agencies, and other organizations to reduce cybersecurity risks. It offers a taxonomy of high-level cybersecurity outcomes that can be used by any organization — regardless of its size, sector, or maturity — to better understand, assess, prioritize, and communicate its cybersecurity efforts. The Framework does not prescribe how outcomes should be achieved. Rather, it maps to resources that provide additional guidance on practices and controls that could be used to achieve those outcomes.

The Framework has been used widely to reduce cybersecurity risks since its initial publication in 2014. NIST seeks to ensure that CSF 2.0 is effective for the future while fulfilling the CSF's original goals and objectives and requests feedback on whether this draft revision addresses organizations' current and anticipated future cybersecurity challenges, is aligned with leading practices and guidance resources, and reflects comments received so far.

Feedback on this CSF 2.0 Public Draft, as well as the related Implementation Examples draft, may be submitted to cyberframework@nist.gov by 4 November 2023.

View the release announcement.
Download the CSF 2.0 Public Draft.
Download the Implementation Examples Discussion Draft.

Learn more about the CSF.

INCOSE 2023 Election Ballot

INCOSE has announced the slate of candidates who are vying for important leadership positions. Successful candidates will assume their new roles during the 2024 International Workshop. Voting (available to Regular and Senior members in good standing) begins on 1 September and closes on 21 September.

The open positions/terms of office and candidates (with a link to their vision statements) include:

INCOSE President-Elect (President-Elect 2 years / President 2 years

- Paul Nielsen
- Mike Watson

INCOSE Treasurer (2 yrs)

- Alice Squires
- Tony Williams

INCOSE Director for Outreach (3 yrs)

- Bernardo Delicado
- Stueti Gupta

INCOSE Director for Asia Oceania (3 yrs)
NOTE: Only Asia Oceania Chapter Presidents are able to vote for this position.

- Quoc Do
- Ramakrishnan "Ramki" Raman

Visit the 2023 Election website.

Record Impact of the System Dynamics Review

The System Dynamics Society (SDS) reports that its System Dynamics Review (SDR), published quarterly by Wiley, is experiencing record growth in its Impact Factor. Impact Factor is a measure of the frequency with which a scholarly journal is cited in other works, an indicator of the overall impact that the ideas published therein are having on a broader discipline. The SDR's Impact Factor has reached 4.8, a four-fold increase since 2017. Congratulations to the Executive Editor, Andreas Größler, and the SDR publications team, reviewers, and authors.

Learn more about the System Dynamics Review here.
View the latest SDR issue.
View the full database and most accessed SDR articles here.
Join the SDS to gain full access to the System Dynamics Review.

SYSTEMS ENGINEERING NEWS

Modelica Association News

Modelica is a freely available, equation-based, object-oriented language for convenient and efficient modeling of complex, multi-domain cyber-physical systems described by ordinary differential, difference and algebraic equations. The Modelica Association is a non-profit organization that develops coordinated, open access standards and open source software in the area of cyber physical systems. The Association publishes a quarterly newsletter. Here are some the highlights from the latest newsletter.

FMI News
This article provides the latest news concerning FMI, including an overview of the soon-to-be released FMI 3.0.1.

MAP eFMI: New Website, Tools and Tutorial
The official website of the Modelica Association project - Functional Mock-up Interface for embedded systems (MAP eFMI) - is finally on air. Besides drafts of the upcoming standard, the website provides a good overview of the eFMI technology, motivation, available tooling, documentation and introductory material, example eFMUs and a project organization overview. The first commercial tools with support for eFMI are officially released and available on the market including:

- AUTOSAR Builder, CATIA ESP and Dymola by Dassault Systèmes
- TargetLink by dSPACE
- TPT by PikeTec

An introductory tutorial of eFMI tooling will be provided at the upcoming 15th International Modelica Conference 2023. The tutorial will cover the whole eFMI workflow with a running example and give participants a hands-on chance to try eFMI integration in the above-named tools.

Modelica Vendor News
Modelica vendors highlighted numerous new capabilities:

- The Wolfram Virtual Technology Conference will take place on 1-3 November.
- Wolfram System Modeler 13.3 has been released with key features such as distribute libraries, real-time simulation interactions, expanded simulation analysis and many more.
- Version 2023.1 of TLK DaVE has been released. DaVE is a visualization software for post-processing and online display of dynamic data sets.
- orchideo easySSP v1.2.6 is now available and comes with an updated UI for Parameter editing and new Simulation features.
- Version 1.21.0 of OpenModelica was released with numerous incremental and software quality improvements.
- Modelon's 2023.2 release includes significant updates to its set of Modelica libraries for thermal power, vapor cycle, air conditioning, vehicle dynamics and electrification.
- A blog post, Integrating Carbon Capture and Sequestration (CCS) with Natural Gas Combined Cycle Power Plants, highlights the use of Modelon Impact in understanding the impact of power plan designs on global emissions.

News from Libraries
Modelica libraries are continuously expanding their capabilities, including:

- A newly released Rotating Machinery library will enable testing of novel designs for machines such as turbines, motors and drivelines.

- An open-source Multi-Domain Drone Modeling Library is available to support simulation-based studies of Unmanned Aerial Vehicles (UAVs).

View details of these and other announcements in the latest Modelica Association newsletter. Subscribe to the newsletter and other Modelica messages here.

Learn more about the Modelica Association.

Editor-in-Chief - IISE Transactions on Healthcare Systems Engineering

The Institute for Industrial and Systems Engineering (IISE) has issued a Call for Nominations for the position of editor-in-chief of IISE Transactions on Healthcare Systems Engineering. This position is a four-year, non-renewable term beginning January 1, 2024.

IISE Transactions on Healthcare Systems Engineering, an official journal of IISE, publishes original high-quality papers on healthcare related topics of interest to researchers who want to remain current with cutting edge approaches to healthcare problems. The refereed journal aims to foster the healthcare systems community by publishing papers that have a strong methodological focus and direct applicability to healthcare systems.

Qualifications for the Editor-in-Chief include:

- Professional membership in IISE.
- A demonstrated interest in the broad topics covered by the journal.
- A demonstrated record of research, scholarship and application in one or more of the topical areas covered by the journal.
- Prior editorial experience, dedication and enthusiasm for IISE and its journals.
- Ability to effectively and efficiently manage the editorial process.

Nominations should include a resume of individual qualifications with experience that includes industrial engineering research related to healthcare and research administration. Self-nominations are encouraged. Nominations will be accepted until 10 September 2023.

Send nominations to:
Donna Calvert, Chief Operating Officer
Institute of Industrial and Systems Engineers
3577 Parkway Lane
Suite 200
Norcross, GA 30092
dcalvert@iise.org

Call for Papers: Modeling and Simulation for Software-Intensive Systems: from IoT to Digital Twins

A Call for Papers has been issued for a Special Issue of the *SIMULATION: Transactions of The Society for Modeling and Simulation International* journal. The Special Issue will focus

on "Modeling and Simulation for Software-Intensive Systems: from IoT to Digital Twins".

Scope

Digital Twins (DT) constitute the latest evolution of software-intensive systems and have been a transformational trend in many domains, such as smart manufacturing, precision healthcare, and smart energy management. By enabling real-time synchronization with its physical counterpart, a DT can provide descriptive, diagnostic, predictive, and prescriptive functionalities. Many of these functionalities are enabled by simulation. Due to the multidisciplinary nature and complexity of DTs, their correct and efficient development is especially challenging. Cyber-Physical Systems (CPS) are primary candidates for digital twinning. They are well-entrenched in our daily lives as the primary means of combining cyber (digital) reasoning capabilities with real systems, their environments, and their physical surroundings. The Internet-of-things (IoT) is the collection of physical objects, typically with sensing and/or acting capabilities. As such, IoT is the physical connectivity underpinning CPS and by extension, DTs.

As the next generation of systems is expected to be more value-driven than ever, it is important to shed light on the state-of-the-art results and remaining challenges in each of these three realms, as well as the cross-cutting concerns, such as extra-functional properties and development processes spanning across the three realms. To this end, this Special Issue focuses on new developments in Modeling and Simulation (M&S) in support of the design, operation, and maintenance of modern software-intensive systems, spanning from IoT, through CPS, to DTs, or any combination thereof.

Topics of interest:

- Foundations and methods
- Applications and tools
- Machine learning and optimization for Digital Twins, CPS, and IoT
- Empirical, secondary, and tertiary studies
- Human factors and sustainability
- Lifecycle models, agile methods, DevOps, TwinOps, etc
- Frameworks, standardization, certification

Key dates are:

- Paper submissions due: 22 November 2023
- Notification: 22 January 2024
- Major revisions due: 28 February 2024

Download the Call for Papers.

Updates to SE Tools Database (SETDB)

The Systems Engineering Tools Database (SETDB), developed by PPI in partnership with INCOSE, provides a virtual venue for engineering tool vendors to communicate their latest offerings. Recent SETDB updates, including both new tools and updates to existing tools, include:

Vendor: Expert Choice

- Comparion®: Designed to leverage the collective wisdom of your organization, while helping decision-participants overcome the limits of the human mind to synthesize qualitative and quantitative inputs from multiple stakeholders using an Analytical Hierarchy Process (AHP).
- Riskion®: Revolutionary, web-based risk management tool designed to help enterprise-level businesses identify, accurately measure, and mitigate potential risks through professional crowdsourcing and mathematical models that will end your reliance on inferior spreadsheet swags.

Vendor: IncQuery Group

- IncQuery AUTOSAR UML Bridge: The ultimate solution for Assisted Documentation Creation and Automated Handover. It can streamline your automotive engineering workflow by generating high-quality UML models from AUTOSAR projects, with built-in ISO26262 and ASPICE compliance.

Vendor: Palisade (Lumivero)

- The DecisionTools Suite: An integrated set of programs for risk analysis and decision making under uncertainty. The DTS integrates seamlessly with Microsoft Excel, and includes: Monte Carlo simulation, predictive neural networks, decision trees and sensitivity and statistical analysis.
- @RISK: An add-in to Microsoft Excel that lets you analyze risk using Monte Carlo simulation. @RISK shows you all possible outcomes for any situation - and tells you how likely they are to occur enabling to decided which risks to take on and which ones to avoid.
- RISKOptimizer: Combines the Monte Carlo simulation technology of @RISK, Palisade's risk analysis add-in, with the latest solving technology to allow the optimization of Excel spreadsheet models that contain uncertain values. RISKOptimizer runs a Monte Carlo simulation for the best simulation results.

Vendor: SPEC Innovations

- Innoslate: The first web-based MBSE tool, was developed by SPEC Innovations to support the entire system or product lifecycle. This cloud or on-premise application simplifies system or product development while reducing time-to-market, cost, and risk.

Vendor: Statistical Design Institute, LLC

- Apogee: Monte Carlo: Monte Carlo analysis is a powerful way to assess the magnitude and shape of response variation caused by the variation of the parameters. It approximates each response distribution by randomly generating single values for each of the input parameters, and computing a value for each response.

PPI SyEN readers are encouraged to check out these new and updated systems engineering tool offerings.

Access the SETDB website.

IEEE Requirements Engineering (RE'23) Conference

Registration is open for the 31st IEEE International Requirements Engineering 2023 (RE'23) conference to be held in Hannover, Germany from 4-8 September. The conference enables researchers, practitioners, students, and educators to meet, present and discuss the most recent innovations, trends, experiences, and issues in the field of requirements engineering. In addition to the main conference with 46 presentations, RE'23 will host six high-quality tutorials and thirteen workshops.

Keynote talks for RE'23 include:

Do We Publish Credible Evidence (Claes Wohlin, Blekinge Institute of Technology, Karlskrona, Sweden)
Software engineering has moved towards being a more evidence-based discipline. For example, systematic literature studies have become a standard practice in our field. However, to be evidence-based, we, as authors of both primary and systematic literature studies, still need to ensure that we publish credible evidence that researchers and practitioners alike can build upon. The keynote will discuss evidence and illustrate that we need to take action to become more evidence-based and that we are all responsible for improving as authors, reviewers, program chairs and editors. Some of the problems are illustrated generally, and then the findings from analyzing a sample of requirements engineering papers are presented before concluding the presentation.

A Paradigm Shift in the Automotive Industry and its Requirements? (Rainer Dammers, ETAS – Empowering Tomorrow's Automotive Software, Stuttgart, Germany)
The automotive market is currently going through significant transformations. Until recently embedded SW was perceived as 'necessary evil' - needed for the ECU to function but not providing direct value. This is rapidly changing. Consumers view a vehicle as a smartphone on wheels - in reality it's a data center on wheels. In this era of the Software Defined Vehicle (SDV) the importance of software is growing, allowing the value of a vehicle to increase over time - compared to today where a vehicle loses value as soon as it rolls of the assembly line - due to the ability to update the software in the field and incrementally add capabilities over a lifetime. These needs lead to new requirements regarding lifetime maintainability and re-usability, changing vehicle E/E architectures, and new collaboration models across software domains, from deeply embedded software over edge software to (cloud) backend systems. In addition to the software itself this paradigm shift is changing requirements against development processes, methods and tools. ETAS started early to adapt to the change. In this talk we will share our experience tackling these changes.

Search-Based Software Engineering in the Era of Modern Software Systems (Federica Sarro, University College London)
This keynote introduces the use of Search-Based Software Engineering (SBSE) to tackle some of the most pressing ethical requirements posed by modern software systems. For example, in automated decision-making software systems and social systems, fairness and safety properties become prominent concerns, whereas the dramatic increase in CO_2 emission due to the use of Artificial Intelligence generates growing concerns for software sustainability.

While the main requirement for more traditional software systems is to provide the user with the right functionalities (i.e., implement the functional requirements correctly), realizing modern and more complex software systems involves ensuring that a software is designed, implemented, and deployed in a way that considers the impact it has on users, society, and the environment. This calls for more comprehensive engineering practices for developing software systems with a focus on ethical, social, and environmental considerations, dubbed as responsible software engineering. However, realizing this type of systems often involves finding the best or most effective solution among a vast number of possible alternatives and one cannot expect for a software engineer, even the most expert, to be able to manually find all possible opportunities. On the other hand, SBSE provides a framework to systematically explore and evaluate these alternatives, allowing engineers to identify optimal or near-optimal solutions.

In this keynote, I will show how SBSE can be a flexible and powerful mean to produce multiple variants of a software system empowering decision-makers to make informed choices that balance conflicting objectives and that align with their goals and priorities. I will present some recent results from my group and others on the use of SBSE for responsible software engineering and discuss directions for future work towards realizing more responsible software systems.

Presentation content for RE'23 is organized into the following tracks:

- Research Papers: Original research papers focusing on traditional areas of requirements engineering, as well as new ideas which challenge the boundaries of the area.
- RE@Next! Papers: Venue to present ongoing work that has generated early or preliminary results.
- Industrial Innovation Papers: Full industry papers, presentation-only contributions, invited presentations, and interactive formats for discussing the most recent innovations, experiences, and concerns in the discipline of Requirements Engineering.
- Posters and Tool Demos: Opportunity for researchers and practitioners to demonstrate and try out their methods and tools as well as gather feedback about them from the conference attendees.
- Artifacts: To foster reusability of a dataset, tool, script, experimental protocol, codebook, or other executable or non-executable object in the requirements engineering field.
- Doctoral Symposium: Opportunity for Ph.D. students and doctoral candidates to present their research work in progress to the panel of internationally renowned RE experts and receive constructive feedback.
- Workshops: Opportunities for small-group discussions on topics in requirements engineering research and practice.
- Journal-First: Authors of selected journal-first papers to present and discuss their research with the RE community.
- RE Cares: A series of RE sessions and designathon to work with real stakeholders to elicit and specify requirements as well as to develop an initial design and prototype early features.

See program details.
Register for RE'23.

SERCTALKS: How Can Model Governance Aid Digital Engineering Execution?

On 6 September, the Systems Engineering Research Center (SERC) will continue its virtual *Celebrating Systems Engineering Digitalization* Talk series by featuring Dr. Heidi Davidz, an Engineering Fellow in the Intelligent Systems Engineering team at ManTech International Corporation. Dr. Davidz will explore how model governance can aid digital engineering execution.

ABSTRACT:

As Digital Engineering employs a digital thread with a broad range of interconnected models, it can be difficult to govern linked models across disciplines and contractual boundaries. After an introduction to model governance in this context, the importance of governance is discussed and the relationship to solution debt described. Contributing standards are reviewed, and characteristics of a solution provided.

As an example, the ManTech Elastic Model Governance Guide for the digital thread is shown. Key features include: (1) model-based guidance with in-model work instructions; (2) integration of the overall Model Governance System, Digital Engineering Environment infrastructure, individual models, and composite models; (3) scoping of model purpose and resolution of solution debt; (4) automated validation for insight on compliance; (5) customization for flexibility and tailoring.

Excerpts from this governance guide are provided and discussed, and next steps are given. Potential model governance research topics are suggested. Integrating model governance practices with additional mechanisms for flexibility, scalability, and automated validation provides robust control over the Digital Engineering ecosystem to enhance the value delivered to customers.

Register here.

View the previous talk in the this series, "What are the Myths and Facts About Implementation of Digital Engineering in DoD Acquisition?"

See previous SERC TALKS series and topics here.

Program Updates for PDMA Inspire Innovation Conference

The Product Development Management Association (PDMA) has updated the program schedule for the Inspire Innovation Conference to be held on 16-19 September 2023 in New Orleans, Louisiana, USA. Held in conjunction with the Journal of Product Innovation Management (JPIM) Research Forum, this four-day in-person event focuses on product innovation processes, gaining and exploiting customer insights and portfolio management.

Representative session topics include:

- Customer Insights in a Pinch: ChatGPT, Social Monitoring and Good Old Brainstorming
- Improving Decision Making in Innovation
- Improving Decision Quality During Stage Gate Reviews
- Leveraging Digital Health Innovation to Close the Global Health Care Delivery Gaps
- 360° Discovery: Unlock More Customer Insight from Within Your Company
- Creating Beautiful, Living Product Roadmaps
- Voice of Customer in Product Design

- Digital Product Development Strategy: Maximizing Success Through Strategic Prioritization
- Overcoming Idea Addiction to Scale Your Ventures
- Level Up Your Product: Innovation with Game Mechanics

View the full conference schedule.
Register here.

PDMA Australia: Idea to Launch Masterclass

The Australian chapter of the Product Development Management Association (PDMA) is hosting an Idea to Launch masterclass in Sydney on 19-20 September. This Systematic Innovation Governance course is a hands-on interactive masterclass facilitated by Gerard Ryan of Prodex Systems. Students will learn processes for moving from strategy to ideas and ideas to successful product launch. The workshop includes a keynote live presentation from Canada by innovation scholar Dr. Robert Cooper.

Learn more and register here.

Nordic Systems Engineering (NoSE) Autumn Tour

INCOSE's five Northern European chapters (Norway, Denmark, Sweden, Finland, Germany) have hosted the Nordic Systems Engineering (NoSE) Tour since 2013. The NoSE 2023 Autumn Tour will be the 12th in the series and will take place on 20-22 September. The Tour will include meetings in three sites:

- Linköping, Sweden (20 September)
- Copenhagen, Denmark (21 September)
- Hamburg, Germany (22 September)

Each site will include a full-day program with relevant presentations by systems engineering practitioners and thought leaders. Although the NoSE Autumn 2023 agenda is being finalized, the program for NoSE Spring 2022 and NoSE Spring 2023 provides a good sample of the types of content to be expected.

Participants may register independently for each site here.

IIBA Webinar: Mastering Agile Backlog Management

The International Institute of Business Analysis (IIBA) is hosting a free open-access business analysis webinar on 27 September titled *The Rock Crusher: Mastering Agile Backlog Management*. Based on the same-named book, the authors - Steve Adolph, Shane Hastie, and Ryland Leyton, will delve into the world of agile backlog management, sharing their insights and expertise on how this essential tool can transform an organization's agility and productivity.

Anticipated takeaways include:

- Discover how the backlog serves as a powerful repository for prioritizing and visualizing work items.

- Hear practical techniques to enhance agility through backlog refinement and adaptation.
- Understand the benefits of a flow-based agile approach to backlog management in driving productivity and efficiency.
- Get burning questions answered by the esteemed authors and experts themselves.

Register here.
Learn more about the IIBA.

World Agility Forum 2023

The World Agility Forum (WAF 2023) will take place in Lisbon, Portugal on 22-26 September 2023. From its beginning in 2014, this conference has gathered the global agile community, practitioners, and experts to create momentum for agile practices. Organized by Agile Thinkers®, the theme of this year's in-person event is *Reimagining Management – Human Factors – Agile*.

By theme area, presentation topics and tracks include:

Reimagining Management 22-23 September	Reimagining Management as Entrepreneurship • Setting the Context • C-SUITE Talk - Reinventing Management • C-SUITE Talk - How Corporates Reimagining Management through Partnerships for Open Innovation Interactive Deep-Dives • CEO perspective • 3rd party perspective • Middle Management perspective • 9 Principles of Leadership Debates • The Tesla Case • When technology makes management irrelevant • Reimagining Governments
Reimagining Human Factors 25 September	• Complexity Fitness • Town Hall "No Way Out - Human Factors in the Age of AI" • The Flow System & Essence - Pieces of the Puzzle • Get a room, and let's get visual! • Human Centered Design • Optimally Functioning Organizations & Rapid Change Need Optimally Functioning Brains • The Games We Play - Changing the Game Leaders Play • Human Factors in Software Engineering
Reimagining Agile 26 September	Tracks: • Technical Agility • Business Agility • Agile Across Organizations

CONFERENCES, MEETINGS & WEBINARS

View the full conference agenda.
Learn more about the distinguished conference speakers here.
View the companion courses associated with this event.

Register for WAF 2023.

NAFEMS Modeling and Simulation Events

NAFEMS is hosting a diverse slate of modeling and simulation conferences and seminars during the remainder of 2023. These events address recent advances in engineering and simulation disciplines and unmet challenges for the simulation community.

Artificial Intelligence and Machine Learning for Manufacturing
NAFEMS North America will host this online seminar on 21-21 September with a focus on engaging industry, academia, and software providers in the process of generating real value from AI and ML. The seminar will feature use cases from some of the most active players in the AI/ML field and explore the synergies and differences between machine learning and traditional engineering processes, look at how artificial intelligence is already being used in simulation, and how it can be used more widely while retaining credibility. Presentation topics include:

- Three Practical AI Use Cases for Manufacturing Processes
- Hybrid Digital Twin for Monitoring and Tuning Gas Treatment Unit
- Multilayered Large Language Models Strategies for Generating Time Series Simulation Data
- Physics-Based vs. Data-Driven Methods to Accelerate Battery Test Cycles
- Enabling IT/OT Integration using Digital Twins of Business Processes
- AI and Machine Learning Enabling Manufacturing Process and Supply Chain Transformation

How to Enable Complex Simulations: The Power of Multiphysics & Digital Thread
This in-person seminar hosted by NAFEMS North America will be held in Milwaukee (Wisconsin, USA) on 17 October. Presenters will share ways to tackle complex problems using cutting-edge simulation technology and tools. Topics include enabling a digital thread, credible simulation for the product lifecycle and multiphysics solutions. Domains of interest include:

- Chemomechanics: Li batteries, bioengineering
- Fluid mechanics: Fluid-structure interaction (FSI), Wind energy
- Solid mechanics: biomechanics, structural mechanics
- Electromagnetism: Motor modeling, Battery design, Solar
- Mechanical design: CAE applications, Motor mechanics, heavy industries
- Optimization: Grid storage
- Other: Heat transfer, Acoustics

International Multiphysics Conference 2023 and International Multibody Dynamics Conference 2023
NAFEMS will host these two co-located and coordinated in-person conferences in Munich, Germany on 14-15 and 15-16 November respectively. The theme for the Multiphysics conference is *A Key Technology for Simulation-Driven Engineering*. Organized jointly by NAFEMS Multiphysics Working Group, The International Society of Multiphysics, and the Fraunhofer Institute for Algorithms and Scientific-Computing (SCAI), the Multiphysics conference will highlight the role of simulation-driven engineering in the virtualization of the development of real-world designs, devices, and processes.

Presentation tracks include:

- Industrial Applications
- Multiphysics in Computational Fluid Dynamics / Fluid-Structure Interaction
- Multiphysics in Computational Electromagnetics
- Verification & Validation / Acoustics
- Multiphysics and Multibody Dynamics

Keynote presentations include:

- The Role of Machine Learning and Numerical Simulations in the Digitalization of Manufacturing Industry
- Efficient Frequency Sweeps for Optimization of (Vibro-) Acoustic Radiation Problems

The companion Multibody Dynamics conference will provide an overview of state-of-the-art-methods for the simulation and design of complex systems, mainly within the context of industrial applications and CAE. Multibody Dynamics Simulation (MBDS) has become a key discipline thanks to its ability to virtually test complex system designs composed of many components and with various types of physical forces acting on them. Successful optimal design is not limited to meeting functional requirements, but also extends to meeting tighter regulations, faster time-to-market and budgetary expectations, and customer expectations for better products. To meet those challenges, MBDS has been evolving in two opposite, but highly complementary directions. On one side, models with higher fidelity enable the representation of more and more complex behavior of physical systems. On the other side, the use of reduced order models, which are now capable of running real time analyses, has opened the door to new technologies like model in the loop, software in the loop, hardware in the loop, and so on, making early testing of systems possible by enabling the interaction of virtual components with real hardware.

[The Challenges of New Advanced Simulation Techniques](#)
NAFEMS Iberia will host this free, in-person seminar in Madrid, Spain on 16 November focused on new challenges in the product design process when leveraging advanced modeling and simulation capabilities. Topics include:

- Collaborative conceptual modeling (multi-disciplinary, inter modeling, etc.),
- Computational challenges (ubiquitous computing, big data, Internet of Things, cloud computing, supercomputing, etc.),
- Digital twins (validation, optimization, data collection/generation/interaction, predictive systems, etc.),
- Uncertainty (tools and methods, management, risk, decision-making processes, etc.),
- Model reuse (tools, effectivity, robustness and reliability, management, etc.).

The [Call for Presentations](#) for this event is open through 16 September.

Join NAFEMS [here](#).

International Modelica Conference 2023

The [International Modelica Conference 2023](#) will take place as a face-to-face conference on 9-11 October 2023, in Aachen, Germany. The conference will bring together people using Modelica and/or other Modelica Association standards modeling, simulation, and control applications, Modelica language designers, tool vendors and library developers. The conference will cover topics such as the following:

- Multi-engineering modeling and simulation with free and commercial Modelica libraries
- Modelica applications of (automotive, thermodynamic, mechatronics, robotics, energy systems, medicine/biology, mathematical programming, teaching, etc.)
- Large-scale system modeling
- Discrete modeling techniques
- Real-time and hardware-in-the-loop simulation
- Simulation and code generation for embedded control systems
- Simulation acceleration by use of many CPU cores or GPU cores
- Applications of Modelica for optimization and optimal control
- Modelica modeling, simulation and design tools
- Symbolic algorithms and numerical methods for model transformation and simulation
- New features of the Modelica language and of the Functional Mock-up Interface (FMI)
- Experimental language designs and implementations related to Modelica

Learn more here. Register here.

Asia Oceania Systems Engineering Conference (AOSEC 2023)

The 14th Asia Oceania Systems Engineering Conference (AOSEC 2023) will be held in Bangalore, India on 11-14 October 2023. The theme of this conference is *Digitalization for engineering Complex Systems*. Systems Engineering, enabled by interoperable model-based tools and techniques, empowers the management of complex product and service development. Attendees can expect to hear from leading experts in the field, participate in engaging workshops, and network with peers from around the world.

Check here for the updated conference agenda.
Learn more about AOSEC 2023.
Register here.

NDIA Systems and Mission Engineering Conference

The U.S. National Defense Industrial Association (NDIA) is hosting its 26th Annual Systems and Mission Engineering Conference in Norfolk, Virginia on 16-19 October 2023. This in-person conference targets the U.S. defense community including representatives from industry, government, and academia. Typical attendees include Program Managers, Systems Engineers, Chief Scientists and Specialty Engineers/Engineering Managers. The theme of this year's conference is *Systems Engineering in the Digital Age*.

Presentation topics span the following areas:

- Enabling Agile Throughout the Lifecycle
- Mission Engineering / System of Systems
- Actionable Architecture / MOSA Impact
- Model Based Systems Engineering (MBSE)
- Test & Evaluation
- Digital Engineering Environment (DEE)

- Digital Twin
- Physics-Based Modeling & Simulation
- System Security Engineering (SSE)
- Safety and Environmental Engineering (SEE)
- Specialty Engineering (Human Systems, Reliability, Maintainability, Supportability)
- Program Management
- Education & Training

Learn more here.
Register here.
Join the NDIA and receive a conference discount.

2023 IIBA Australia Festival of Business Analysis

The Australia chapter of the International Institute of Business Analysis™ (IIBA®) is hosting the 2023 IIBA Festival of Business Analysis (FOBA) on 16-20 October 2023. The theme of this hybrid multi-site (Australia and New Zealand) conference is *"Empathise. Evolve. Emerge"* to highlight the need for business analysis professionals to foster adaptability and perpetual growth in the face of change.

The in-person elements of this conference will move across Australia and New Zealand as follows:

- 16 October – Auckland
- 18 October – Adelaide
- 18 October – Brisbane
- 19 October – Melbourne
- 19 October – Perth
- 20 October – Sydney

The online portion of the conference will run from 16-20 October and have a unique speaker lineup.

A sample of the guest speakers and their topics include:

- *From Isolation to Innovation: Fostering Dynamic Communities of Practice for Limitless Growth! (Mike Harris, Ramya Palraj)*
- *41 Shades of Design Thinking for Agile (Dr Amanda Keenan)*
- *Your Backlog is Broken – here's how to fix it. (Shane Hastie)*
- *Hacking at Empathy & Innovation (Michelle Bell)*
- *Project Failure due to Outputs rather than Outcomes (Tim Coventry)*
- *How to unlock your biggest asset – People – to understand your customer needs (Aleks Dimeski)*
- *When Crisis strikes, call a BA: Coming to the Rescue when all hell breaks loose (Philipp Joebges)*
- *Buy a Feature (Ryan McKergow)*
- *Human Centred Innovation for Industry 4.0/5.0 Businesses (Rashan Senanayake)*
- *Evolving Perspectives: Cultivating Skills for Transformative Change (Faith Timbs)*
- *Using AI for better decisions faster (Avishkar Misra)*
- *"Analysis" is so old-school; welcome to the age of "Synthesis"! (Arash Arabi)*
- *Articulative Communication with Process-bility (Kevin Tan)*
- *Impact of Artificial Intelligence on Digital Transformation (Mashhood Ahmed)*
- *The 3 "S's" of User Stories (Kathy Berkidge)*
- *A standard process and visual blueprint for the design of complex software systems (Craig Errey)*

CONFERENCES, MEETINGS & WEBINARS

- *Business Architecture: Establishing Your Operating Model As A Core Strategic Asset (*Terry Roach*)*
- *Innovation Elegance: What a People-Centric Methodology Looks Like* (Robert Snyder*)*
- *Workshop – Design Thinking for Innovation (*Phil Delalande*)*
- *Navigating the Red Ocean: The Blue Ocean Business Analyst's Guide to Success (*Deon Rademeyer*)*

Learn more and register.
View prior-year events (2022, 2020).
Learn more about IIBA.

Keynotes and Registration: Symposium on Automated Technology for Verification and Analysis (ATVA 2023)

The 21st International Symposium on Automated Technology for Verification and Analysis (ATVA 2023) will take place in Singapore on 24-27 October 2023. ATVA 2023 is dedicated to the promotion of research on theoretical and practical aspects of automated analysis, verification and synthesis by providing a forum for interaction between international research communities and industry in the field.

Keynote talks for the conference have been announced, including:

Correct and Efficient Policy Monitoring, a Retrospective (David Basin, Professor of Computer Science, ETH Zurich)
The MonPoly project started over a decade ago to build effective tools for monitoring trace properties, including functional correctness, security, and compliance policies. The original goal was to support monitoring in expressive specification languages and handle both the online case, where system events are monitored as they occur, and the offline case, monitoring logs. The original MonPoly tool supported monitoring in first-order metric temporal logic (MFOTL), where events can be stored in finite databases or automatic structures, represented by automata. Since then our tool has evolved into a family of tools and supporting infrastructure to make monitoring both scalable and suitable for high assurance applications. We survey this evolution which includes: (1) developing both more and less expressive variants, e.g., adding aggregation operators, regular expressions, and limited forms of recursion as well as considering more efficiently monitorable fragments and new monitoring algorithms for them; (2) designing support for parallel and distributed monitoring; (3) using theorem proving to verify monitoring algorithms and explore extensions; and (4) carrying out ambitious case studies to learn where bottlenecks and limitations are in practice.

Dynamic Assurance Cases for Machine-learning based Autonomous Systems (Ewen Denney, NASA Ames Research Center)
There is increasing interest in the use of machine learning technologies for safety and mission-critical applications, e.g., deep neural networks for perception in self-driving road vehicles, but the relevant regulations that would give the bases for assurance have not kept pace. Risk-based approaches to trust, in the form of argument-based safety cases, have shown promise for the assurance and subsequent operational approval of novel systems.

We describe work on the dynamic assurance case (DAC) concept – a model-based, multifaceted approach to the assurance of safety-critical systems – and its application to several ML-based autonomous systems. Our vision is one of a rich, expressive, and rigorously-founded framework, going well beyond how argument-based safety cases are currently developed.

Privacy in Machine Learning (Reza Shokri, Professor of Computur Science, National University of Singapore)

The quantification of privacy risks associated with algorithms is a core issue in data privacy. I will introduce a systematic approach to assessing the privacy risks of machine learning algorithms. I will highlight the efforts towards establishing standardized privacy auditing procedures and privacy meter tools, based on membership inference algorithms, to identify vulnerable algorithms and check compliance with privacy regulations. I will also explain the interconnections between this methodology and the concept of differential privacy, and what it means for an algorithm to be robust against inference attacks.

Learn more about ATVA 2023 program here.

Register for ATVA 2023 here.

Note that ATVA 2023 and the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC 2023) will be co-located this year, and thus an option for registering both is provided.

The Market Research Event (TMRE23)

TMRE THE MARKET RESEARCH EVENT

PPI SyEN readers with a particular interest in understanding stakeholder needs may want to consider participating in The Market Research Event (TMRE23) that will be held on 23-25 October 2023 in Denver, Colorado (USA). TMRE23 will continue a 20-year heritage by gathering consumer insight leaders to identify emerging trends in market research.

Keynote talks for the conference have been announced, including:

How to Change Minds (David McRaney)
How do our beliefs and opinions change so drastically from one period of time to another? David McRaney has uncovered and woven together the latest research across fields of psychology - research that reveals that even though it seems like real change takes generations to become visible, it can happen within a lifetime, within minutes. McRaney explores changes big and small, from gun control and marijuana legalization, to the changes we experience every day. He reveals new ways we can see and bring about change in our individual lives, at work, at home, and in our personal relationships.

Anatomy of a Breakthrough: How to Get Unstuck at Work, at Home, and at Play (Adam Alter)
Feeling stuck? You're not alone. Almost everyone feels stuck in some way, unable to push past some kind of roadblock. But it doesn't have to be this way. Bestselling author Adam Alter has spent the past two decades studying the forces that keep us stuck- and how we can free ourselves to thrive. He says that most of the barriers we face are subjective, which means we have everything we need to get unstuck and push through to success.

In this ground-breaking talk, Adam draws on his new book Anatomy of a Breakthrough to weave together scientific studies, anecdotes, and interviews to teach us how to get unstuck from whatever's holding us back. He reveals the formula that he and other researchers have uncovered: called the "friction audit," the process helps you figure out why you (or your organization) are stuck, then suggests a path to progress by overcoming the three kinds of frictions (head, heart, and habit), so you can find the breakthrough that's just around the corner. Full of practical strategies that you can put into play on your own or as a team - like sacrificing in the short-term for long-term gains, or taking challenges as a signal that you're moving beyond the easy wins - this talk is a must-listen for anyone interested in innovation and high achievement.

How to Apply Future Trends to Your Business Today (Sheryl Connelly)
Sheryl Connelly offers audiences a look at the potential futures of their industries and offers tips for

scenario planning at their organizations. From exploring aspects you can't control to planning for multiple futures, she looks at how embracing the future, rather than fearing it, opens up immense opportunities for businesses to thrive.

Tracking changes across social, technological, economic, environmental, and political arenas and shifts in consumer attitudes and behaviors, she shares insights on the emerging trends that will most affect business in the years to come. Connelly begins by breaking down broad, "bird's-eye view" trends like declining fertility rates, the global talent shortage, China and India, and the rising female frontier. She then moves to ground-level trends like ethical consumption and access versus ownership to assets. She takes these concepts and applies them to current patterns and predicted patterns in consumer behavior. Her unsurpassed grasp on the future of business proves invaluable as she helps audiences take advantage of what's next.

The Future of Calm Technology (Amber Case)
The age of AI has arrived, yet instead of clarity, we're overwhelmed with an incessant stream of information about its future. The general reactions include uncertainty, fear, and a sense of being overwhelmed. Many companies feel they are forced into a relentless race to catch up. This fear-driven approach, however, generates a murky path of disruptive forces.

In this era defined by swift technological innovation, Amber Case advocates for the concept of Calm Technology, a framework coined in 1995 by PARC Researchers Mark Weiser and John Seely Brown. Calm Technology aims to design ubiquitous devices that engage our attention appropriately, allowing technology to amplify humanness instead of taking it away. The idea behind Calm Technology is to have smarter people, not things. Technology shouldn't require all of our attention, just some of it, and only when necessary.

This speech will revisit concepts from the AI pioneers of the 80s and 90s, the thinkers behind Calm Technology and ubiquitous computing. The keynote will cover how to use principles of Calm Technology to design the next generation of consumer experiences. By learning from examples like teapots and inner office windows that provide information without demanding constant attention, we can create technology that works harmoniously with the human lifestyle and environment.

The Human Brain and Its Future: How to Make Your Brain More Creative, Productive, and Effective (Heather Berlin)
The unconscious mind and brain is more powerful and active than we ever imagined, says Dr. Heather Berlin. Knowing that, how can we optimize ourselves for success, i.e. hack our own cognitive systems? Berlin studies the seemingly mysterious topics of creativity, consciousness, and willpower, helping us to better understand ourselves and others, including what they want and how to help them.

This fascinating talk unlocks the secrets of attention, perception, and human wellbeing, and shows how these human traits are key to the future digital economy. Businesses with a clear view of how they work will have an edge on competitors, and leaders who know how to boost creativity in their employees will see massive success. We can all make better decisions and get the most out of our brains, Berlin says - but we need to understand them first.

Gen Z Decoded: A Young Innovator's Journey for Social Change (Gitanjali Rao)
Coming of age during unprecedented times, no generation has redlined the rulebooks and upended traditional thinking quite as much as Gen Z. Gitanjali will take the stage at TMRE to provide a glimpse into the heart and minds of the next consumer powerhouse from one of the most acclaimed Gen Z-ers herself.

Impact Magnified: Insights & Analytics Illuminate the Future (Elaine Rodrigo)

Known for her strong drive for impact, Rodrigo found her 'Why' evolving over time to be about People and Purpose. As the head of market research for a multinational CPG with products sold in more than 200 countries, Rodrigo shares her vision for transforming change into opportunity that delivers mega results for businesses, more rewarding careers for ourselves and our teams and builds a better world. In her powerful keynote at TMRE 2023, you'll gain unique insight into the monumental impact consumer behavior can play in driving both societal change and business growth.

Beyond the keynotes, TRME23 content is organized into multiple streams, including:

- New Best Practices
- The Future of Work
- Unlock Data's Potential
- Consumer Ready
- Game-changers: AI/INTECH Spotlight
- Spearheading Growth & Innovation
- Innovating Insights
- AI for Consumer Understanding
- Fresh Brand Insights
- Shopper Insights for CPG & Retail
- Media & Entertainment Insights
- Insights in Highly Regulated Industries
- Insights Leadership Skills Masterclass
- Story-telling with Data Masterclass

Learn more about TMRE23 program agenda.

An optional pre-conference event, AI for Insights & Analytics, will take place on 22 October.

Register for TMRE23.

Program Updates: IEEE VIS 2023 - Visualization and Visual Analytics

The program has been updated for the IEEE Visualization and Visual Analytics (VIS 2023) conference in Melbourne, Victoria, Australia on 22-27 October. VIS 2023 will convene an international community of researchers and practitioners from universities, government, and industry to exchange recent findings on the design and use of visualization tools.

In addition to the keynote speakers and workshops highlighted in last month's PPI SyEN, VIS 2023 will offer a set of eight tutorials:

Visualization Analysis and Design
This introductory tutorial will provide a broad foundation for thinking systematically about visualization systems, built around the idea that becoming familiar with analyzing existing systems is a good springboard for designing new ones. The major data types of concern in visual analytics, information visualization, and scientific visualization will all be covered: tables, networks, and sampled spatial data. This tutorial is focused on data and task abstractions, and the design choices for visual encoding and interaction; it will not cover algorithms. No background in computer science or visualization is assumed.

A Hands-on TTK Tutorial for Absolute Beginners
This tutorial provides a basic, beginner's introduction to topological data analysis and visualization

with the Topology ToolKit (TTK). While previous editions of the TTK tutorial (2018 to 2022) were organized as mini-symposia (focused on the descriptions of TTK's latest features), this year, in contrast, we would like to organize a very basic beginner's hands-on tutorial. Specifically, the goal of this tutorial is to accompany attendees in the installation of TTK on their laptop as well as in the running of a few basic examples, all in a very beginner-friendly step-by-step description. This decision is motivated by attendee feedback which we collected at previous editions of the TTK tutorial. We address this feedback in this tutorial proposal. Then, for the first time, beginners would be able to come to the tutorial without prior TTK experience, and walk out with TTK installed on their system, capable of running a few examples and ready to go further. We believe this basic hands-on tutorial will facilitate the adoption of TTK and topological techniques to a broader audience. The tutorial will be organized as follows. The first hands-on exercise will be dedicated to the installation of TTK. The second hands-on exercise will be focused on ParaView's basic usage. The following three hands-on exercises will be dedicated to the step-by-step replication of three examples extracted from TTK's online example database (vortex extraction in fluid dynamics, Morse-Smale complex extraction in quantum chemistry and merge tree comparison in ensemble data).

NLP4Vis: Natural Language Processing for Information Visualization
This tutorial will introduce natural language processing (NLP) to interested researchers in the visualization (Vis) community. It will first motivate why NLP4Vis is an important area of research and provide an overview of research topics on combining NLP and Vis techniques. Then an overview of deep learning models for NLP will be covered. A particular focus will be provided on highlighting the recent progress on large language models such as ChatGPT and how such models can be leveraged to solve various NLP tasks for visualizations. In the final part, we will focus on various application tasks at the intersection of NLP and Vis. We will conclude with an interactive discussion of future challenges for NLP+Vis applications. The audience will include researchers interested in applying NLP for visualizations as well as others who focus more generally at the intersection of AI and visualization.

Demystifying Color in Your Data Visualizations
This tutorial provides an overview of the basics of color theory while exploring various color mysteries. New to 2023, we show how to use Adobe's Firefly, a creative generative AI model in Beta, to expand your data color scheme choices. You also learn how to build your own colormaps by transforming color harmonies. Several puzzling notions are examined. These include but are not limited to discovering that Magenta is not a spectral color, merging Red and Green lights results in Yellow, and most Blues in Data Visualizations turn out to be Cyan-Blue combinations. The course is intended for a broad audience of individuals interested in understanding, applying, and building color schemes for data visualization.

With a five-stage colorization process, you learn how to build and select a data color scheme with color harmony, incorporate color models concepts and address color deficiency. You discover the differences between mixing colors in perceptual, display, printer, and traditional painter color spaces. For example, you learn how to transition from Red as a primary hue in RGB display space to Red as a secondary combination of Magenta and Yellow in CMYK printer space. You explore online and mobile color apps, like Adobe Firefly, and HCL Wizard, to help with continued colorization. Many of these tools are freely available. Along the way, color vision principles, perceptual uniformity with the Hue Chroma Luminance (HCL) model as well as color gamut, spaces and systems are examined. Concepts like extending the fundamentals of the Bauhaus into digital media, the Rainbow colormap dilemma, and overviews of appearance principles are covered. Bring your digital visualization examples for hands-on experiences with color suggestion tools.

Mining Useful Information Via Complex Network Visualization

The process of visually representing networks of connected entities, links as well as nodes is termed network visualization, also referred to as graph visualization or link analysis. The proposed tutorial is intended to provide a detailed coverage of contemporary complex network visualization techniques to support the understanding of various existing complex systems. The tutorial covers the basics of complex networks along with various visualization techniques under faceting perspective, application perspective and system perspective. After introducing several use cases of complex networks, the critical challenges incurred while developing multi-layer graph visualization will also be covered. Furthermore, future research directions are uncovered to address such challenges. Multilayer networks are expected to play a significant role in the study of complex systems in the future. It will bring the visualization community closer to the application domains as well as the complex systems communities.

Transparent Practices for Quantitative Empirical Research

Transparent research practices enable the research design, materials, analytic methods, and data to be thoroughly evaluated and potentially reproduced. This tutorial presents current best practices and tools that increase research transparency for VIS researchers, practitioners, and students. The tutorial will cover the most relevant concepts, guidelines, and practices in Open Science - how to transparently conduct quantitative empirical research, report the results, and share the artifacts of your research. We will also include exercises where participants will be able to apply transparent research practices.

TAURUS: a Unified Framework for Creating Graph Layouts

Graph layout is a key technique in graph visualization. There is a wide variety of techniques related to graph layout available, but there is no suitable tutorial to help new researchers understand the differences and connections between these techniques. In this tutorial, we will systematically classify existing graph layout techniques such as force-based and stress-based models and explain the connections between them. Using our framework TAURUS, we will map most of them to a unified formulation, which helps to compare them. In parallel we will show the effects of the techniques by interactively generating results using our fast solver, various parameters will be edited to show the effects of the different methods. In the second part of the tutorial, we will focus on non-physical-based models such as tsNET that do not follow a physical metaphor. At the end, we will move towards machine learning for graph layouts and show various applications for graph layout.

The tutorial introduces the fundamentals and state-of-the-art graph layout. Rooted in a theoretical perspective, it introduces design concepts and algorithmic principles of many graph layout methods. It will help beginners to enter the field of graph layout fast and advance their research. Our tutorial includes both course instructions as well as interactive demonstrations, participants can play around with all concepts using the TAURUS website and our library.

Design Sprints for Visualization

Design sprints describe a time-constrained, interdisciplinary process based on rapid prototyping and testing to define goals quickly, validate ideas, and decide on a final design. The well-defined, interactive, and time-constrained design cycle makes design sprints well-suited both for teaching active-learning-centered visualization courses and for creating visualizations in real-world settings. In this tutorial, we will conduct a complete design sprint workshop, showcasing its value both in a classroom setting and for real-world applications. The tutorial contains 5 sections, each with guided active-learning activities. The tutorial starts with a theoretical introduction to design sprints, and then progresses through each of the five stages: Map, Sketch, Decide, Prototype, and Test. Each section will explain the technique, followed by hands-on experience performing the step. We conclude the tutorial with a show-and-tell, where groups can present their final design to all participants.

Watch here for more VIS 2023 program details.

CONFERENCES, MEETINGS & WEBINARS

Register here.

TdSE 2023 Conference

INCOSE's German chapter, GfSE (Gesellschaft für Systems Engineering e.V) is hosting its annual conference, Day of Systems Engineering (TdSE®), in Würzburg, Bavaria, Germany from 15-17 November 2023 with its motto as "*Future needs courage!*"

Keynote talks for TdSE 2023 include:

Sustainable Business by valuable Systems (Nico Michels, Siemens Industry Software GmbH)
What does "Sustainable Business" mean? Sustainable business means that companies today also integrate social issues and challenges with a view to realigning their strategic goals. However, it also means that issues such as sustainability, energy self-sufficiency and technological sovereignty should be understood as opportunities for new business opportunities.

A key enabler for companies in this context is the digitization of business processes. Because historically, we, the entire industry, have an unprecedented number of technological options for the development, production and operation of products and services for our customers. To leverage the business potential mentioned, in addition to holistic, automated and digitized process chains for value creation, strong ecosystems and cooperation across company boundaries are also required.

How strong ecosystems can be used to support companies in the best possible way in exploiting the business potential of "Sustainable Business" is the subject of this presentation. It will be shown how - in the context of digital transformation - the synergetic consideration of operational technology (OT), information technology (IT) and product architecture can be achieved with the help of systems engineering, thereby creating new opportunities for Europe as an industrial location.

BIM, the MBSE for infrastructure projects? (Jan von Tongelen, CSEP, Rücker + Schindele Beratende Ingenieure GmbH)
The planning method Building Information Modeling (BIM) is the present and future of construction planning in Germany and in an international context. It is the method for implementing digitization in the construction sector and for enabling an integral and collaborative way of working in all disciplines.

BIM considers all phases of the project life cycle from "planning" to "construction" to "operation" and "dismantling" holistically. The new quality of cooperation leads to more transparency in the planning process, to better planning results and enables new use cases over the life cycle. BIM networks the countless individual factors of processes and dependencies in an overall model (visual and functional) including the component information and is therefore the enabler for networked and intelligent construction.

How the BIM planning method Systems Engineering takes up principles and implements Systems Engineering in the construction industry will be discussed in the lecture. An insight into the application of systems engineering in the design of complex infrastructure projects is to be given.

TdSE 2023 will offer a wide range of full-day and half-day tutorials on 15 November:

- From the concept model via formal concept analysis (FCA) to the ontology of requirements
- Requirements, system architecture definition and FMEA modelling
- "Solution Architecture Mindset" for the industrial MBSE implementation
- A digital and machine-executable V-model for model-based systems engineering of

complex systems with design languages
- NLP4SE – What Does Natural Language Processing Bring to Systems Engineering?
- AI-based optimization of competing system properties to achieve sustainability goals
- Siemens MBSE - modeling concepts, business processes and software solutions for interdisciplinary system lifecycle engineering
- Web-based reviews of architecture models - GitHub pull requests for system models
- MBSE as an enabler for sustainability in the system architecture
- pure-systems GmbH – Product Line Engineering according to ISO 28580
- Smart requirements management in system development with ReqSuite® RM
- Agile Systems Engineering - how to electrify your racing car

The lecture program on 16-17 November will offer five concurrent tracks with a total of sixty presentations.

See program details.
Register for TdSE 2023.

Learn more about GfSE here.

Capella Webinar: Digitally Assisted Design for Safety

Capella Webinar

On 14 September Pablo López Negro, Chief Innovation Officer at Anzen Engineering, will deliver a free webinar titled "*Digitally Assisted Design for Safety*" that highlights the use of the Arcadia method, Capella software and Anzen's ATICA extension in support of system safety design.

Abstract:
Is your system robust to the loss of one or more functions? Does your system require interaction with other systems to operate safely? Does the design and operational concept of the system include contingency means? Do these contingency means correctly mitigate the risks?

These and other similar considerations are becoming more important with the emergence of autonomous systems and complex systems of systems. The introduction of digital tools and in particular model-based systems engineering allows to capture the complexity of these products starting from the operational analysis and supporting the process throughout the whole product life cycle.

With ATICA, system architects and designers will be able to analyze safety implications starting from the conceptual needs and mission description; modeling risks associated to the system, assessing the probability of occurrence and severity, and deciding upon the needs of contingency and mitigation means. ATICA enriches the Arcadia framework and provides safety analysis capabilities for each step of the system definition, design, and verification process.

In this webinar, we will address an example with an autonomous vertical take-off and landing (VTOL) vehicle, conceived for operation in urban environments (urban air mobility). We will present the operational description and system architecture, and we will conduct the Functional Hazard Analysis (FHA) directly from Capella and aligned with the normative standards in force in the aeronautic industry (ARP-4761 / ED-135).

Finally, we will introduce safety analysis covering the logical and physical architecture levels, showcasing the use of Capella, Arcadia and ATICA for Fault Tree Analysis (FTA) and Failure Modes and Effects Analysis (FMEA).

Register here.

INCOSE Los Angeles: Operational Analysis and Mission Engineering

The INCOSE Los Angeles chapter will be hosting a hybrid event on 26 September as part of the INCOSE-LA Speaker Meeting series. Rob Day of the Caltech Center for Technology and Management Education will present a talk titled *Operational Analysis and Mission Engineering: A strategy and framework to develop any industrial ecosystem*.

Abstract:

Today's industries face the ever-increasing business dynamics of changing technologies, competition, and regulations that affect their products, services, and processes. Yet, many enterprises aren't looking at it from a system thinking perspective - they focus on the product development perspective without considering an integrated view of business, operational, development, and manufacturing perspectives.

This presentation will explore the application of operational analysis and mission engineering to identify opportunities and their subsequent missions and relationships. Through this understanding, we can clarify how the enterprise sits in the ecosystem and ensure our strategy and vision meet or exceed our business and customer needs. Through this approach, we can also ensure enterprise efficiency, effectiveness, and market penetration enable sustainable growth while embracing technology and minimizing the socioeconomic impact on society.

Register here.

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> *Successful projects are usually conducted with clear objectives, by competent people, in a supportive environment, using effective processes based on sound principles.*
>
> **Robert Halligan**

PPI Reflections on INCOSE International Symposium (IS2023)

by Robert Halligan, René King, Randall Iliff, John Fitch & Rebeca Carniero
Project Performance International

Introduction

Project Performance International "sent" a team of five to participate in the INCOSE International Symposium (IS2023) that took place in Honolulu, Hawaii on 15-20 July. The PPI team consisted of Robert Halligan, Randy Iliff, René King (who took advantage of the virtual option), John Fitch and Rebeca Carniero. This article summarizes our reflections on what we saw, heard, learned and felt during IS2023 and hopefully highlights important insights and trends concerning the discipline of systems engineering as applied to our shared global challenges.

PPI Principal Consultant and Course Presenters, Randall Iliff and John Fitch, with Independent Information Technology and Services Professional Ken Ptack.

PPI Managing Director Robert Halligan with Embraer Senior Systems Engineer Natalia Rocha.

PPI Marketing Coordinator Rebeca Carneiro with INCOSE Advertising Administrator Jo Corbett.

PPI Business Development Manager and Senior Engineer, René King, participating virtually in Monday's keynote presentation by Matthew Kamakani Lynch.

Figure 1 – PPI's IS2023 Team Enjoying Time with Our Peers

FEATURE ARTICLE

Some Facts and Figures

IS2023 took place at the beautiful Hawaii Convention Center in Honolulu, just over one mile from famed Waikiki Beach. The first two days of this event, 15-16 July, focused on the delivery of a variety of half-day and full-day tutorials on key systems engineering concepts, methods and skills. PPI's John Fitch taught a full-day workshop on *Leveraging Decision Patterns* that provided examples of the decision patterns for product/system, service, enterprise and courseware design that form the basis for PPI's Project Decision Jump-Start Services. The tutorial gave participants to opportunity to learn the basic skills needed to apply these patterns to their current projects and to create a digital thread built around decision-to-everything traceability.

The main portion of the IS2023 program kicked off on Monday, 17 July with an opening plenary. It was announced that over 1000 participants had registered, approximately 750 in-person and nearly 300 using the virtual option. The excellent attendance likely derives from increasing interest in systems engineering as problem/solution complexity increases, the post-Covid desire for increased engagement with peers, and perhaps lure of tropical beaches nearby.

An Inspiring Start

Contributed by Randy Iliff

The opening plenary speaker, Matthew Kamakani Lynch (Former Director of Sustainability Initiatives, The University of Hawai'i System), reminded all of us that systems are much more than just our day job, and that the natural systems our very lives depend upon are experiencing a period of unmanaged change.

- No systems engineer should be comfortable with the thought of depending upon a largely undocumented legacy system, composed of millions of highly interdependent elements, that was just suddenly knocked out of an eons-long period of self-ordered equilibrium.
- The traditional engineering "Disaster Response" is complicated by a total lack of central design or management authority, primary stakeholders who are often literally at war with each other, and secondary stakeholders who are personally at war with a reality they do not wish to accept.
- Just to complete that SE nightmare, imagine that every living thing on the planet is inescapably exposed to whatever emergent properties arise – not just at eventual equilibrium, but throughout the entire path of wild oscillations that occur as a by-product of instability. Billions have already died, and for many more, even a modest further excursion from historical baseline will be fatal.

My friend and colleague Richard Beasley asked the obvious question about everyone meeting on an island and the overall impact of travel involved in attending such an event. What I took away from Richard's question, and Matthew's eloquent response, was that being mindful of the required energy investment to attend in person placed a responsibility on me to maximize my connections at the IS and thus unlock the greatest possible emergent benefit for the world.

An investment is only wasted if it does not produce a meaningful return.

That perspective places a further responsibility on me not to squander even a single gift of new connection, but instead to nurture each of those seedlings over time just as I might with a product family or other valuable IP holding.

My wish is that everyone who attended the IS, in person or virtually, takes a moment to reflect on the enormous potential return on investment that keeping even a few new connections alive offers. Those connections might be to mentors, professional peers, or providers of tools and knowledge that we

utilize to accomplish the magic of SE.

As an example of how easy this is to do once we make connecting a priority, here is an extract from the note that I sent to Matthew after the IS that has since blossomed into a promising friendship:

> *My life has been defined by a small number of highly important inflection points – and all of those have occurred as a result of connections given to me by forces I simply accept rather than try to understand. I have a profound sense that experiencing your presentation at INCOSE is one of those gifts.*

> *I mentioned being one of the founders of INCOSE – I'm member #48 – and my motivation over thirty years ago has not changed. We live in a world of complex systems, we depend on complex systems for our survival, and we ourselves are complex systems. My motivation was not to build better weapons or even better medical devices – it was to help humans adjust to reality before our time runs out.*

> *I believe the ability to see the connections that exist among everything around us is a necessary societal maturation – as fundamental an adjustment to reality as acquiring object permanence as a child – and equally critical to our chances of understanding and altering the trajectory we are on.*

> *This is not something we must do for the first time, but rather a gift our ancestors possessed that we've since lost. (Perhaps "sold to the highest bidder" is a more appropriate description of that transition.)*

> *When 500 people sit in a room as individuals, or 8 billion occupy a planet without a meaningful sense of interdependency, there is no possibility of a beneficial emergent property arising.*

> *Your brief activity at the IS – deeply moving to me and everyone else that I spoke with – created 500 connections that did not exist previously. How many will be sustained is another question, but at least some will survive. That is an act of pure creation – a gift to the world with all the potential that implies, and none of us know what cascade sequence will be triggered as a result.*

> *My profession, and my particular slice of interest within the field, exists to establish and manage relationships such that elements are connected in a way that delivers a desired emergent property to stakeholders.*

> *As an example of the enormous possibility I see in this means of communication, in any system of 500 independent elements, there are 249,500 possible connections. (And that is just the first-order connection set – there are far more beyond that!)*

> *At the INCOSE IS your activity tapped into just two tenths of one percent of the available potential, yet that experience still left the audience deeply moved. People who would never settle for .2 % energy conversion efficiency in a power plant were delighted by an equivalently awful level of performance with human communication, they just don't know they are doing it.*

Later in the day I was in the Americas Sector Chapter Leadership meeting, and in addition to great conversation with old and new friends, I had an opportunity to share some of the ways that the Chicagoland Chapter had success building connections with their membership. Here are some of the highlights of that discussion:

- *Chicagoland (and I suspect all chapters to some degree or another) has a wide range of member interests and motivations. These are present, simultaneously, and represent the overall target market we wish to serve.*
- *The value delivery channel of a monthly meeting has very limited bandwidth, and attempting to serve every one every time in a couple hours is simply not realistic.*

- *What Chicagoland did was to treat the problem much like a monthly magazine editor or commercial product manager would and figure out how many discrete sub-constituencies are present.*
- *From there it just becomes a question of how to "interleave" focused content over time such that every one gets something they really want often enough to remain engaged.*
- *The logic is basically time-domain multiplexing, with the usual penalty of increasingly high overhead if you try to interleave too many small slices, and increasingly undesirable wait times if you elect to send just a few giant message packets instead.*
- *At least at one point, the three main interest areas that Chicagoland supported were:*
  - *Professional development and certification.*
  - *Mastery of key SE principles.*
  - *Dealing with real-world challenges and barriers.*
- *We added another topic area of interest to both members and the chapter as a stakeholder:*
  - *Building outreach connections with the community and other professionals*
- *The goal was to interleave these areas of emphasis so that the they changed from meeting to meeting, but continuity within a topic was never really lost since the topic had come up "recently" and would do so again in the "near future."*

One immediate observation is that 12 events a year, less if you discount holiday and social interactions, offers very limited communication bandwidth to support a diverse community of interests. Common solutions include adding channel capacity in the form of "lunch and learn" calls, working group meetings, Spring and Fall tutorials and so on.

My point here is that chapter leadership has an opportunity to utilize familiar SE principles to more effectively manage the system of communication used to deliver interesting and relevant content to membership. That is the secret to a healthy and growing chapter community – continuously nurturing existing connections and creating new ones at the frontier of awareness.

The more elements you can support, the richer the set of systems you can achieve as a result!

Distribution of Paper/Presentation Topics

Contributed by John Fitch

Every paper presented at an International Symposium is tagged with one or more author-assigned labels to reflect the type of content that it contains. Because of the cross-cutting nature of most submissions and the desire to appeal to the broadest possible audience, papers are generally tagged with more than one such label. Nevertheless, the distribution of papers across these labels can provide insight into the current priorities of the INCOSE "branch" of the systems engineering community.

Filtering the IS2023 offerings by category labels yields an interesting "tiering" that separates tagged paper topics into three strata based on frequency:

Tier 1 – Significantly most frequent tags:
- MBSE
- System Architecture/Design Definition
- Processes

Tier 2 – Frequent tags

- Modeling/Simulation/Analysis
- Systems Thinking

- Verification/Validation
- Needs and Requirements Definition
- Business or Mission Analysis
- Decision Analysis and/or Decision Management

Tier 3 – Also-rans

- Twenty-eight other categories with significantly less frequent use. Examples include Natural Systems, System Dynamics, Configuration Management, Lean SE, Human Systems Integration, Software-Intensive Systems, etc.

It's likely that INCOSE's emphasis on MBSE in the Vision 2035 document and the Future of Systems Engineering (FuSE) initiative have shaped both the topical focus of papers submitted and those that survived the paper evaluation gauntlet. The first four fit that hypothesis well as MBSE is an enabler for system architecture/design and overlaps the modeling/simulation/analysis category. And some of the papers associated with system engineering process design and improvements focus on how to adapt existing processes to make them more "model-centric".

The second tier includes bread-and-butter systems engineering process elements that span the development lifecycle, i.e., Needs and Requirements Definition, Business or Mission Analysis, Decision Analysis/Management and Verification/Validation. The only outlier is Systems Thinking, not surprising because of its foundational role in supporting all aspects of systems engineering.

Best Paper Awards and Associated Themes
Contributed by John Fitch

At each International Symposium, Best Paper Awards are given to a small subset of the submissions. At IS2023, five papers received this award, plus one for Best Student Paper. These awards provide a window into global systems engineering trends (from the perspective of their authors, who are generally methods innovators) and into the current priorities and vision of INCOSE (from the perspective of the seasoned evaluators, who are generally systems engineering thought leaders).

Orion SysML Model, Digital Twin, and Lessons Learned for Artemis I

- By Gregory Pierce and Terry Hill - NASA Johnson Space Center; Joshua Heeren - Jacobs

ABSTRACT: In 2015 it was recognized by NASA's Orion Chief Engineer that NASA's design insight into the Orion subsystems for Artemis I was not sufficient to provide standard engineering support to flight operations. To address these concerns, provide an opportunity to apply emerging model-based systems engineering and digital twin methodologies, and provide opportunities for employees across NASA to get hands-on training, an Orion Digital Twin pilot project was initiated in 2020 as part of the Agency's Digital Transformation initiative. With the increase in complexities of spacecraft, and decreased time to made decisions during missions in critical or emergency situations, digital modeling and integration of design can reduce the time to answer questions by days and the required human resources by an order of magnitude over conventional approaches and was identified to be a critical capability for NASA's future. This paper describes the genesis of the Orion Digital Twin pilot project, efforts undertaken, a reproducible methodology to take available system information from a mature program to create an executable SysML model that supports a link to the physical asset, and associated lessons learned and project deliverables.

Takeways from this talk include:

- Initial problem - the current NASA paradigm for design and operations of complex space systems involves excessive work to capture, maintain, access and digest/use lifecycle knowledge.

- Digital twin technology applied to complex aerospace systems appears promising – may significantly reduce the time and resources required to answer important lifecyle questions.
- Value must be demonstrated with example of the methods, tools, and language needed to implement an effective digital twin of a complex aerospace system.
- A digital twin is a virtual representation of real world entities and processes, synchronized at a specified frequency and fidelity.
- NASA stood up a Digital Transformation Office to define digital twin processes, methods, etc.
- Created Orion program digital twin to enhance the human interface with data to increase decision velocity and accuracy.
- Developed integrated schematics and curated views based on SysML (a parsable language).
- Users found dynamic navigation of these digital artifacts helpful in analyzing mission/problem scenarios.
- Lessons learned include improved synchronization of design artifacts, reduction in human errors and deconflicting diagrams and parametric equations.
- Using the term, "twininess" to define the extent, by scope and degree, that a system model is a digital twin.
- Leveraged the Capabilities Periodic Table from the Digital Twin Consortium (DTC) to frame this initiative.

Architecting Descriptive Models for MBSE

- By Ryan Noguchi - Aerospace Corporation

ABSTRACT: Model Based Systems Engineering (MBSE) is becoming increasingly recognized as a critical enabler for significantly improving the effectiveness and efficiency of systems engineering. While MBSE is seeing significant growth in its application to complex system development programs, the growth of MBSE adoption and realized value is often stymied by the growth of technical debt in the descriptive models that serve as the foundation of knowledge capture and communication in an MBSE environment. The methods and practices of system and software architecting can be readily adapted to address the technical debt growth problem often seen in the development of descriptive models. This paper describes the emerging discipline of "model architecting," comparing and contrasting it with system and software architecting practices. The paper describes a representative set of model architecting patterns that illustrate model architecting principles, then identifies some of the key roles, responsibilities, and competencies required of the model architect.

Takeways from this talk include:

- In a data/model-centric engineering culture evolving knowledge is captured in authoritative sources that are connected through federated sets of digital models
- SE must transition to MBSE to enable such a Digital Engineering transformation.
- Benefits include more efficient, consistent, higher-fidelity and timely data management, faster and reliable data exchange and less misinterpretation of artifacts.
- Descriptive models of systems may be thought of as a system; they can and should be architected.
- System architecture can be characterized as a set of decisions.
- A generalized system architecting process includes Purpose Analysis, Problem Space Exploration & Refinement, Solution Space Exploration & Refinement, Harmonization & Analysis and Decision Support. These may be adapted to architecting descriptive system models.
- Design patterns provide well-tested solutions to widely-observed design problems.

- Heuristics also support architecture definition.
- The model architect has critical decisions to make about the model federation architecture and implementation. Poor choices lead to expensive refactoring efforts.
- The model architect is a bit of a unique beast (with both problem/solution domain understanding and process skills) and is essential to the long-term success of MBSE.

BEST STUDENT PAPER - System verification via Model-Checking: A case study of an autonomous multi-differential drive robot)

- By Ibukun Phillips and Robert Kenley; Purdue University-Main Campus

Model-Based Systems Engineering (MBSE) has been utilized in practice for the design and behavioral modeling of cyber-physical systems. The Vee model helps frame MBSE's lifecycle approach, with system verification a vital aspect of the qualification process. However, popular modeling language tools in MBSE, such as Systems Modeling Language (SysML), are incapable of formally verifying these systems. Model checking allows for the development of formal system models similar in abstraction to SysML models for automatically checking if these formal models satisfy formal specifications. We propose an approach to translate behavioral diagrams in SysML, such as state-machine diagrams, to the popular symbolic model checker NuSMV for formal verification. As a case study, we apply this process to autonomous multi-differential drive robots (DDR). Subsequently, the NuSMV model is verified against some formal operational specifications obtained from the requirements diagram of the DDR. This system verification approach can help System Engineers identify design flaws or incorrect modeling or specifications that could be missed during the design phase through the results of the model checking process.

Takeways from this talk include:

- Cyber-physical systems (CPS) represent the integration of physical, communication and computing technology systems and therefore require a multidisciplinary design approach.
- Common modeling languages lack the rigor to support automated design and analysis of CPS.
- A model-checking process combining formal verification methods, system models and SysML/UML diagrams can yield effective formal specification of CPS.
- A case study (multi-differential drive robot – DDR) demonstrates that a proposed model checking process helped identify the faulty requirements in the SysML requirement diagram of the DDR.

Agile Systems Engineering – Eight Core Aspects

- By Rick Dove; Kerry Lunney - Thales Group; Michael Orosz - University of Southern California; Michael Yokell - Raytheon

ABSTRACT: INCOSE's Vision 2035 calls for action on nine system engineering challenges. The purpose of this paper is to addresses one of those challenges directly: "Systems engineering anticipates and effectively responds to an increasingly dynamic and uncertain environment." This paper addresses that challenge by identifying the need and behavior of eight core aspects for a basic comprehensive solution and provides some examples of those aspects in operation.

The paper was triggered by six questions posed by the INCOSE Corporate Advsiory Board (CAB) in 2022 to enable part of SE Vision 2035:

- What does it mean to be agile in the context of systems engineering?
- What are the key practices that can make systems engineering agile?

- How can organizations be more agile in their development of systems?
- What benefits can be gained using agile practices for systems engineering?
- What is the relation between agility and model-based systems engineering (MBSE)?
- Are there system characteristics and architectures that make some systems more amenable to agile development and others less so?

Core aspects of Agile SE that were shared include:

- *Product Line Architectures* - Composable and reconfigurable product and process designs from variations of reusable assets.
- *Iterative Incremental Development* - Incremental loops of building, evaluating, correcting, and improving capabilities.
- *Attentive Situational Awareness* - Active monitoring and evaluation of relevant internal and external operational-environment factors.
- *Attentive Decision Making* - Systemic linkage of situational awareness to decisive action.
- *Common-Mission Teaming* - Engaged collaboration, cooperation, and teaming among all relevant stakeholders.
- *Shared-Knowledge Management* - Facilitated communication, collaboration, and knowledge curation.
- *Continual Integration & Test* - Integrated demonstration and test of work-in process.
- *Being Agile: Operations Concept* - Sensing, responding, evolving.

Agile Processes Applied to Los Alamos National Laboratory SE approach: The Agile Processes and Technology (APT) Team

- By Owen Dominguez & Gregory Chavez - Los Alamos National Laboratory

ABSTRACT: APT intends to demonstrate a concurrent and collaborative design process by delivering a qualifiable and certifiable prototype in three years, in contrast to current efforts that can take up to 12 years. APT at Los Alamos National Laboratory's product realization, seeks establish a new set of practices and guidance to approach a new way of doing business at the National Laboratories level. Given the complexity of this task, APT has chosen to adoption of MBSE for the core system management.

Takeways from this talk include:

- Los Alamos National Laboratory (LANL) is attempting to marry Agile-Lean methodology with MBSE to achieve time savings and improve cost efficiencies.
- LANL started process redesign with a blank sheet – used SE processes to design new processes.
- MBSE supports verification and validation activities by enabling acquisition of necessary evidence of traceability and compliance.
- LANL is using the proven Scaled Agile Framework (SAFe) with emphasis on customer-centricity, continuous improvement and regular inspection/adaptation to improve value delivery.
- MBSE is used to enable early conflict identification, manage complexity, maintain a source of truth, preserve traceability, and support informed V&V decision-making.
- Integrated Agile/Lean/MBSE methods and tools support delivery of a qualifiable and certifiable prototype based on customer requirements.

I-SHARE – INCOSE Systems Heuristics Application Repository: Sharing Systems Engineering Knowhow and Experience

- By Dov Dori - Technion, Israel Institute of Technology; Dorothy McKinney – INCOSE; Gan Wang - Dassault Systems; Scott Jackson - Burnham Systems

ABSTRACT: Since 2020, a team of INCOSE Fellows has been creating I-SHARE – INCOSE Systems Heuristics Application Repository, in which over 600 SysE-related heuristics are curated, covering subjects that include SysE competencies, lifecycle stages, expertise, operational domains, and system attributes. We describe I-SHARE, the motivation and stages of its creation and compilation, and ways through which the knowhow and experience it holds can be shared and passed across generations of systems engineers.

Takeways from this talk include:

- The I-SHARE project was launched in 2020 to devise a set of readily available heuristics to be shared among systems engineers.
- Heuristics are mental shortcuts that allow people to solve problems and make judgments quickly and efficiently.
- Heuristics in I-SHARE have been chosen based on criteria such as clarity/conciseness, authoritative sourcing, clearly articulated usage, sense-making in their original context, applicability beyond original context, and ease of rationalization.
- I-SHARE is designed to support multiple use cases.
- Work on gathering, reviewing and publishing heuristics is ongoing.

Thematic Analysis of Best Papers

Consistent with the INCOSE Vision 2035 and the distribution of IS2023 papers across topics (discussed previously), four of the six Best Papers are focused on leading edge use of MBSE. The other two papers address methods to improve system engineering effectiveness by the application of proven heuristics (working smarter) and the Agile methodology (working "smaller" to incrementally deliver value, learn and adapt).

Toward a Digital Transformation and MBSE Framework

Contributed by René King

One of my biggest passions is trying to understand how to set up a robust framework for what MBSE is, what the pillars of Digital Transformation are and how we can best equip organizations to embark on this journey. Thankfully, there was a lot of content at IS2023 that piqued my interest and gave me important elements in my quest. A greater appreciation of the relationship between Digital Engineering, MBSE, Digitalization and Digital Transformation was one the biggest takeaways that I obtained from attending IS2023. Three papers contributed to my increased understanding:

- *Let's Talk Machine! The Digital Transformation of Systems Engineering* (Tim Weilkiens)
- *Orion SysML Model, Digital Twin and Lessons Learned from Artemis I* (Gregory Pierce and Terry Hill - NASA Johnson Space Center; Joshua Heeren - Jacobs)
- *Scalable, Flexible Implementation of MBSE DevOps in VSEs: Design Considerations and Case Study* (Cailin Simpson and Steven Simske - Colorado State University)

Together these presentations enable us to further understand what MBSE and Digital Transformation are in the context of systems engineering, demonstrate an example of how MBSE can be used to take steps down the Digital Transformation Road, and how even small enterprises can carry out systems engineering using approaches such as 'FlexOps' and 'FlexDevOps'.

FEATURE ARTICLE

In his presentation, *Let's Talk Machine! The Digital Transformation of Systems Engineering*, Tim Weilkiens affirms that systems engineering is all about communication. This belief aligns with Conway's Law that states that "organizations design systems that copy their communication structures." In the practice of SE we try to get numerous stakeholders from various disciplines and domains to understand each other. For this purpose we may use various means such as spoken and written language and diagrams, but the ultimate goal is to ensure that we share the same understanding of the system and its development artifacts. Communication methods have evolved from analog (pen and paper, typewriters) to digital (word processing software, graphics utilities) each facilitating numerous breakthrough innovations (despite their limitations) that have changed the human condition.

However, representing information digitally still does not fully leverage the potential capability of modern machines. One of the statements that stood out from Tim's presentation was "*Doing SE with MS Word is like doing mechanical engineering with MS Paint*." That is, the 'machine' has no appreciation of any of the characteristics of the system.

To leverage the capabilities of the machine, models of the system and the thinking that creates the system are required. MBSE tools such as those based on the System Modeling Language (SysML) provide a data structure that captures relationships, the semantics of which may be used to generate diagrams that improve communication among humans stakeholders. The same semantics may be used to support analysis of the system, e.g. to identify which requirements have not yet been satisfied. Weilkiens notes that unfortunately the capabilities of MBSE tools are often underutilized, e.g., using the tools to create images and pasting these images into a document - separating the diagram from the underlying data and losing the core value of the modeling language to capture and retain characteristics of the system. Diagrams such as state diagrams, sequence diagrams and so forth are there to aid human interpretation. The data structure behind the diagrams is what differentiates a MBSE artifact from a general diagram developed in any graphical tool.

Modeling turns data into information by adding semantics to the data.

Weilkiens highlights the fact that the world of modeling isn't static; new concepts such as digital twins, digital threads, digital shadows (it's a real thing) and AI are taking center stage. These techniques all involve machine-based processing of data where machines assume increasing responsibility in storing, managing, and value-added processing of data.

Tim closed his presentation with a powerful quote from one of his colleagues, Andreas Willert, that anticipates the needed modifications to the way will we engineer systems when applying increasingly machine-based methods.

"A picture is worth a thousand words, a model is worth a thousand pictures."

Key takeaways from this presentation include:

- Have a clear view conceptually of your organization's goals with respect to Digital Transformation. Focus on purpose-driven engineering.
- Think big, but break down the journey into small steps.
- Current MBSE tools are archaic and inefficient, i.e., take too many "clicks" to accomplish a simple engineering task. Hopefully SysML 2.0 will alter this reality.
- There remains a place for textual specifications alongside of models, but leveraging the power of the machine requires that the diagrams and text are not disconnected from the data at the level of the model.

The Best Paper presentation (summarized earlier), *Orion SysML Model, Digital Twin and Lessons Learned from Artemis I*, highlighted practical steps required to overcome current MBSE tool limitations and move towards a Digital Engineering paradigm. For NASA's Orion Spacecraft development, the decision

was made early in the development cycle to produce artifacts beyond the need for human understanding.   Emphasis was placed on modeling and the use of MBSE and digital engineering approaches in development to enable increased data-driven decision velocity and accuracy. Consistent with Weilkiens' recommendations, clear organizational goals led to improved project and system performance, despite beginning with a disjoint set of design artifacts that required significant effort to merge/integrate into a coherent model.

Of note, NASA had the resources to stand up a Digital Transformation Office that could blaze new engineering pathways. That poses interesting two related questions:

- "What about Very Small Entities (VSEs) with less than 25 employees?"
- "How can we incrementally implement processes and tooling in a small business to deliver improved software products?"

The paper presentation, *Scalable, Flexible Implementation of MBSE DevOps in VSEs: Design Considerations and Case Study*, attempted to answer these questions. This talk emphasized the complementary strengths of systems and software engineering methods, in particular the potential benefits of combining MBSE with DevOps while remaining sanguine about the implementation challenges of such capabilities.

MBSE	DevOps
Strengths/benefits: - Finding inconsistencies in design earlier in system development - Supporting configuration management - Better understanding of the problem and the solution through multiple representations	Strengths/benefits: - Teamwork - Elimination of silos - Enabling rapid experimentation in the face of uncertainty - Improvement of performance
Challenges: - Higher upfront investment - Poor purpose and scope definition - Change resistance - Lack of executive sponsorship - Competing views on method definition and extensions - Difficulty in setting up the models for modularity and reusability - Tool dependence (vendor lock-in) - Integration and visualisation of very large models	Challenges: - Lack of DevOps process awareness - Lack of support for the process from those who know about it - Implementing DevOps with insufficient technology support - Difficulty adapting organizational processes to support DevOps

The hybrid methodology presented in this paper is known as FlexOps. FlexOps prioritizes the core of DevOps - continuous improvement and delivery, with MBSE's focus - referencing requirements throughout the engineering process, while also considering the overall goal of the VSE which is to

"Deliver a system while remain profitable." FlexOps is a framework that allows for incremental implementation and enables flexibility for VSEs.

The authors highlight one pathway toward FlexOps implementation, the mentorship of VSEs by larger companies with proven MBSE and DevOps capabilities.

Overall the three presentations explored herein all align and echo the following common points:

- Set the purpose of the digital transformation prior to embarking on major steps.
- Create a big goal that is in line with the purpose but then break up the goal into smaller steps that are realistic for the size of the company, especially for VSEs.
- Where possible, establish a digital transformation office or something similar to oversee the digital engineering implementation (similar to a systems process group). This can be very effective for larger companies.
- Employ process models like FlexOps for flexibility to develop in an agile way while employing MBSE and scale as the company grows incrementally.
- Understand that it may require extensive effort to overcome some of the challenges of importing data that is captured digitally in Word, PDF, PowerPoint, etc. Focus instead on parsable formats of data and using MBSE tools to capture data where possible.
- Lower the necessity of forms of content that are convenient for humans unless there is a strong case for investing in these human-oriented presentations.
- Maintain diagrams and data together in the MBSE model - don't copy and paste diagrams into a PDF document except for a rare and specific purpose.

As always, the INCOSE International Symposium directly addressed some of my burning questions, planted new questions for reflection, and fed my hunger to learn more. It is a privilege to be able to attend systems-oriented conferences like IS2023 (even if only virtually) and engage with like-minded people trying to make the world a better place through the power of systems thinking and systems engineering.

View from the Booth

Contributed by Rebeca Carniero

This year was my first time participating in the INCOSE IS, where I had the privilege of staffing PPI's booth. Having been a part of the PPI team for several years and having heard about IS, it was a pleasure to finally have the chance to represent our company at this event.

While I didn't attend any presentations and tutorials myself, I had valuable interactions with the attendees and the lovely INCOSE IS team. During my time at the booth, I had the chance to engage with a diverse group of professionals that showed genuine interest in knowing more about what we do, allowing me to provide an overview of our capabilities and how we contribute to the field.

Being part of the exhibition, allowed me to see firsthand the enthusiasm, interest and dedication of the systems engineering community towards the advancement of SE, where various sectors collectively contribute for innovative solutions and approaches to complex challenges. This experience highlighted the value of knowledge and how its application has the potential to shape the world we live in.

It was an inspiring experience and I am grateful for the opportunity to represent PPI and contribute to the event's success.

Big Picture – Opportunities and Concerns

Contributed by Robert Halligan

Overall IS2023 was immensely impressive for its energy level and the diversity of interests

represented. The days of defense and aerospace dominance of SE take-up and practice are over I believe! Also welcome and impressive was a strong theme of Artificial Intelligence for Systems Engineering (AI4SE) and Systems Engineering for Artificial Intelligence (SE4AI), with some excellent papers, giving IS2023 a distinct cutting-edge profile.

Of some concern - IS2023 highlighted what seems to be increasing confusion between MBSE and Digital Engineering (DE), with a trend towards labeling as MBSE anything that involves a digital "single source of truth" record from which project and product information can be extracted, even in the absence of modeling and even in some cases, the absence of engineering. It's important to note that:

- MBSE can be undertaken without DE (and has been extensively), and
- DE can be undertaken without MBSE (and has been extensively).

For most applications, the ideal is MBSE performed in a DE environment. DE had been around in production engineering and product lifecycle management long before the INCOSE community embraced it! Bringing MBSE into DE delivers the best of two worlds.

In Conclusion

The PPI team thoroughly enjoyed IS2023, both for knowledge shared and human connections made. We look forward to IS2024 in Dublin. See you there!

NAFEMS E-Learning Courses for September - November

E-Learning Courses — NAFEMS offers a diverse range of code-independent, in-depth online training courses on engineering analysis and simulation. Upcoming courses beginning in September - November 2023 include:

Practical Modelling of Joints and Connections (3 sessions; 7 September – 5 October)
The objective of this course is to review the various connection and joint technologies in use, give an overview of the physics involved and show how to successfully implement practical solutions using Finite Element Analysis.

Elements of Turbulence Modeling (2 sessions; 8 – 15 September)
Turbulence models based on Reynolds-Averaged Navier Stokes (RANS) equations are the most common and practical approaches for turbulence simulation. Unfortunately, there is no single universally accepted turbulence model that works for all flows and all regimes. Therefore, users have to use engineering judgment to choose from a number of different alternatives since the accuracy and effectiveness of each model varies depending on the application. This course provides the attendees with basic understanding of complexities in turbulence simulation and introduces them to most commonly used turbulence models with their advantages and limitations.

Next Steps with Multibody Dynamics Simulation (3 sessions; 26 September – 9 October)
This course offers guidance on how to assess and plan the task of carrying out advanced Multibody Simulation Analysis (MDB) of systems and mechanisms. By attending, you will build a theoretical, numerical and methodological background which will allow you to build advanced MBD models.

Understanding Solid Mechanics: Applied Stress Analysis (4 sessions; 28 September – 19 October)
This course aims to provide an understanding of the calculations required to determine the internal forces and stress distributions that correspond to the external loads applied on different structures utilized for their efficiency under certain conditions. The course deals with beams that support bending forces acting along their length, shells and cylinders that support normal forces acting on their surfaces and shafts that support torsional forces.

Practical Understanding of Systems Modelling and Simulation (4 sessions; 3 – 24 October)
The course is an excellent opportunity to learn the fundamentals and practicalities of the critical aspects of systems modelling:

- Complex systems and the method for their development
- Simulation-based process and numerical simulation
- Organization and process for modelling
- Model management and models architecture
- Industry applications

Basic Finite Element Analysis (6 sessions; 3 October – 7 November)
The course offers excellent guidance on how to assess and plan the task of carrying out structural analysis using FEA. Content includes:

- Background to FEA
- Defining your objectives and planning your analysis
- Making healthy models
- Real-world constraints and loading
- Engineering assessment – is your model realistic
- Integrating with CAD and geometry
- Checking the answers

[Introduction to Dynamics using FEA](#) (6 sessions; 12 October – 16 November)
The course will cover a range of topics, all aimed at structural designers and engineers who are moving into the area of dynamic analysis, including:

- Normal Modes Analysis
- Damping
- Modal Coordinates
- Modal effective Mass
- Transient Response
- Frequency Response

[CFD for Structural Designers & Analysts](#) (3 sessions; 13 – 27 October)
This course will cover a range of topics, all aimed at the structural designer and analyst who needs to get to grips with CFD, including:

- Principles of fluid dynamics
- Important flow phenomena
- Basics of the CFD process
- Turbulence modelling
- Fluid-structure interaction

[Understanding Solid Mechanics: Stress Analysis Approaches](#) (5 sessions: 26 October – 23 November)
This course is a starting point towards really understanding solid mechanics. You need to understand the basics to enable you to apply good practice in your finite element analysis, and this course will give you the knowledge you really need for a good understanding of the principles that every engineer or designer should know. Topics include:

- Statics, Forces and Equilibrium in Design
- Elasticity, Stresses and Strains
- Constitutive/Material relationships
- Hand (or 'Back-of-the-envelope') calculations
- Boundary Conditions and Applied Loads

[Introduction to Practical CFD](#) (3 sessions; 3 – 17 November)
This course offers attendees the fundamental knowledge for using Computational Fluid Dynamics (CFD) in real-life engineering applications. Through a simple and moderately technical approach, this course describes the steps in the CFD process and provides benefits and issues for using CFD analysis in understanding of complicated flow phenomena and its use in the design process.

[Simulation of Lubricated Contacts](#) (4 sessions; 6 November – 4 December)
This course is designed to develop skills and knowledge in simulating lubricated contacts using numerical methods. Lubricated contacts form a lubricant film which completely or partially separates contacting surfaces.

[Basic Electromagnetic FEA](#) (4 sessions; 8 – 29 November)

SYSTEMS ENGINEERING RESOURCES

This course will help you to understand basic electromagnetic equations, to master their solution using the Finite Element Method, and to properly interpret and use the results. The course starts with fundamental topics such as electric field, magnetic field, electric scalar potential, and magnetic vector potential. It then guides you through Partial Differential Equations (PDEs) of the introduced scalar and vector fields describing different electromagnetic problems of practical relevance, namely, electrostatics, magnetostatics, eddy current, displacement current, and wave propagation.

[Composite Finite Element Analysis](#) (5 sessions; 21 November – 17 December)
The objective of this course is to break down the composite analysis process into clearly defined steps, give an overview of the physics involved and show how to successfully implement practical solutions using Finite Element Analysis.

[Advanced Dynamic FEA](#) (4 sessions; 30 November – 21 December)
This course covers a broad range of solution types, beyond the usual natural frequency and dynamic response methods. This allows more physical phenomena to be investigated and simulated using dynamics in FEA. Topics covered include: Random Vibration, Shock and Response Spectra, Nonlinear Dynamic Response, Explicit Dynamic Analysis and Complex Eigenvalue Analysis.

View the current [course listing.](#)
[Subscribe](#) to receive NAFEMS updates and other publications.

NAFEMS Resource Center

The [NAFEMS Resource Center](#) maintains an extensive library of modeling and simulation knowledge assets, accessible for download by members (sometimes restricted to conference attendees) and many available to non-members also. NAFEMS members receive free or discounted access to many of these resources.

Types of available resources include:

- Bibliography
- Event Proceedings
- Event Review
- Extended Abstract
- Flipbook Magazine
- Journal
- Journal Article
- Knowledge Base

- Magazine
- Magazine Article
- Manual
- Paper
- Presentation
- Presentation Recording
- Standard
- Webinar

A sample of recent additions include:

- [ASSESS Summary - Takeaways and a Look to the Future](#) (Magazine Article)
- [High Fidelity Physics-Based Electromagnetics Simulation of Advanced Driver Assistance Systems for Autonomous Vehicles](#) (Magazine Article)
- [Benchmark July 2023 - Act Lively](#) (Magazine)
- [Manufacturing Process Simulation using Explicit Dynamics](#) (Webinar)
- [Handling Flexible Bodies in Multibody Dynamics](#) (Webinar)
- [Unlock the Value of Simulation by Establishing Trust in Engineering Simulations](#) (ASSESS Conference Presentation)
- [Asymmetric Constraints, a Multiphysics Modelling Application](#) (Conference Paper)

- [Accelerating Vehicle Design Through the Use of Gaming Engines](#) (Extended Abstract)
- [NAFEMS Dach Magazine Issue 066](#) (German Language Magazine)
- [STEP AP209 Ed2; 2014: Multidisciplinary Analysis & Design](#) (Standard)
- [How to – Model the Additive Manufacturing Process](#) (Publication)
- [NAFEMS International Journal of CFD Case Studies](#) (Journal)
- [Crashworthiness](#)(Knowledge Base)

PPI SyEN readers are encouraged to investigate this deep pool of simulation and modeling knowledge.

Join NAFEMS [here](#).

Business Analysis Podcasts

The International Institute of Business Analysis (IIBA) maintains an open-access library of Business Analysis Live! podcasts that address a wide variety of topics relevant to business analysis professionals. New podcasts are added bi-weekly.

A sample of additions to this library during 2023 include:

- [Solving the Wrong Problem](#) (8 August)
- [What is Strategy Analysis](#) (25 July)
- [Requirements Engineering and Business Analysis](#) (11 July)
- [Curiosity for Business Analysis](#) (30 May)
- [Why Use Observation](#) (18 April)
- [ChatGPT and Business Analysis](#) (31 March)
- [Top 9 Business Analysis Skills](#) (7 February)
- [Business Analysis Myths](#) (24 January)

View the entire [Business Analysis Live! library](#).

Digital Twin Consortium - A Whole Systems Approach to Decarbonization Across the Building Lifecycle

The Digital Twin Consortium (DTC) has published a guide for smart building stakeholders, "*A Whole Systems Approach to Decarbonization Across the Building Lifecycle*". According to the guide, we need to approach buildings holistically; that is, as indivisible components of a larger, constantly regenerating, and self-sustaining system.

The authors propose that we embed sustainability and high energy performance into our buildings, starting early on with the design phase all the way through to daily operation.
Digital twins play a significant role in this endeavor. Embedding operational performance evaluation from the beginning is a key aspect. For the built environment, the guide defines:

- Performance digital twins, for use throughout the entire building development lifecycle
- Asset digital twins, which are used for building operation, and
- Project digital twins, which create dynamic versions of static Building Information Models.

[Download](#)the guide.

SYSTEMS ENGINEERING RESOURCES

Learn more about the Digital Twin Consortium and its Architecture, Engineering, Construction & Operations (AECO) Working Group.

PPI RESOURCES

PPI offers a multitude of resources available to all of our clients, associates and friends! Click on any of the links below to access these resources today.

Systems Engineering FAQ: https://www.ppi-int.com/resources/systems-engineering-faq
Industry-related questions answered by PPI Founder and Managing Director Robert Halligan.

Key downloads: https://www.ppi-int.com/keydownloads/
Free downloadable presentations, short papers, specifications and other helpful downloads related to requirements and the field of Systems Engineering.

Conferences: https://www.ppi-int.com/resources/conferences-and-meetings/
Keep track of systems engineering-relevant conferences and meeting dates throughout the year.

Systems Engineering Goldmine: https://www.ppi-int.com/se-goldmine/
A free resources with over 4GB of downloadable information relevant to the Engineering of systems and a searchable database of 7,800+ defined terms. You can expect the content of the SE Goldmine to continue to increase over time.

Systems Engineering Tools Database (requires SEG account to log in from the Systems Engineering Goldmine): https://www.systemsengineeringtools.com/
A resource jointly developed and operated by Project Performance International (PPI) and the International Council on Systems Engineering (INCOSE). The SETDB helps you find appropriate software tools and cloud services that support your systems engineering-related activities. As a PPI SEG account holder, you have ongoing free access to the SETDB.

PPI SyEN Newsjournal (actually a substantial monthly SE publication): https://www.ppi-int.com/systems-engineering-newsjournal/
You're already reading our monthly newsjournal! However click on the link to access the history of 100+ monthly newsjournals containing excellent articles, news and other interesting topics summarizing developments in the field of systems engineering.

Systems Engineering applies to anything

With practice, I believe you can apply Systems Engineering (SE) to any situation you come across. Everything can be described as a system, and SE applies to all systems, so quod erat demonstrandum.

I recently came up with a random example to illustrate what I mean. The following images show two factories that are situated about 3km apart, each of which happens to be a bastion of SE.

Factory 1

Manufacture

Engineering

Test

Factory 2

Engineering

Everything else:
Manufacture & Test
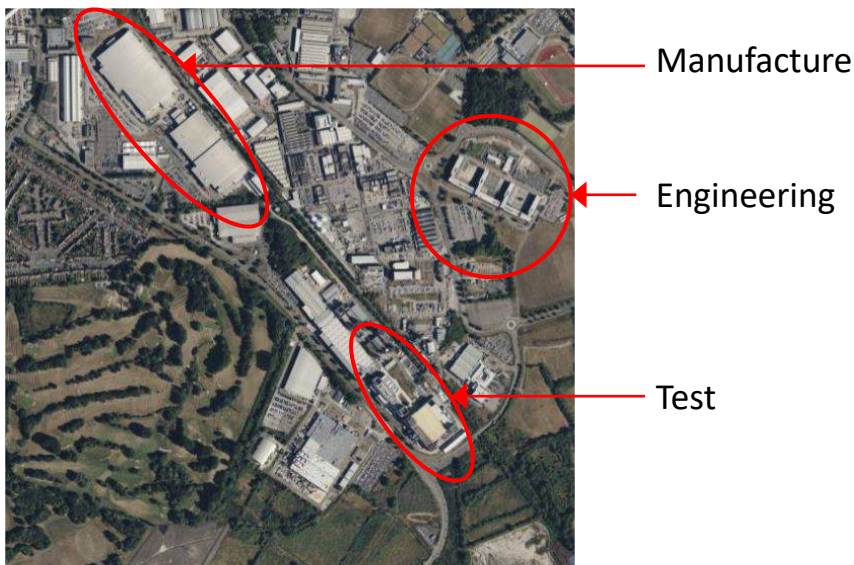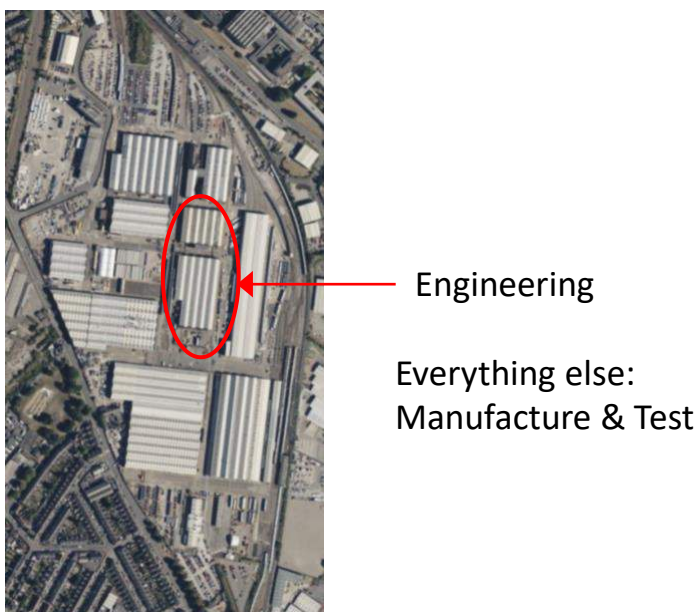
The elements "Engineering", "Manufacture", and "Test" can be described as Enabling Systems from the perspective of the systems that are being produced.

FINAL THOUGHTS FROM SYENNA

According to ISO/IEC/IEEE 29148 and the INCOSE SE Handbook, the *Concept of Operations* (ConOps) would describe which of these Enabling Systems were necessary to "forward the organization's objectives". The ConOps should define which entity owns each one and could presumably discuss any geographical colocation of these functions. Note that "ConOps" is a disputed term, so use it with care!

It's interesting to look at the proportion of space allocated to staff car parks in the two pictures. Those staff are elements within one or more of the Enabling Systems. Factory 2 is tightly restricted in space, so the human elements must modify their commuting arrangements to suit, possibly offsetting global warming.

So next time you want to know what's going on within a building complex, ask to see their ConOps and see where that leads you!

Regards,

Syenna

Upcoming PPI Live-Online ™ Systems Engineering Five Day Courses

Click here to view the full schedule or register for an upcoming course.

P006-925-2	United Kingdom BST 8:00 (UTC +1:00) PPI Live-Online	18 Sep - 22 Sep 2023
P006-925-3	South Africa SAST 9:00 (UTC +2:00) PPI Live-Online (Exclusive to South Africa)	18 Sep - 22 Sep 2023
P006-925-4	Turkey TRT 10:00 (UTC +3:00) PPI Live-Online	18 Sep - 22 Sep 2023
P006-925-5	Saudi Arabia AST 10:00 (UTC +3:00) PPI Live-Online	18 Sep - 22 Sep 2023
P006-924-1	North America MDT 8:00 (UTC -6:00) PPI Live-Online	23 Oct - 27 Oct 2023
P006-924-2	South America BRT 11:00 (UTC -3:00) PPI Live-Online (Exclusive to South America)	23 Oct - 27 Oct 2023
P006-926	Eindhoven, the Netherlands CEST 8:30 (UTC +2:00) In-Person	23 Oct - 27 Oct 2023
P006-927	Las Vegas, United States of America PDT 8:00 (UTC -7:00) In-Person	30 Oct - 03 Nov 2023
P006-928-1	Asia SGT 5:00 (UTC +8:00) PPI Live-Online	13 Nov - 17 Nov 2023
P006-928-2	Oceania AEDT 8:00 (UTC +11:00) PPI Live-Online	13 Nov - 17 Nov 2023
P006-929-1	Europe CET 9:00 (UTC +1:00) PPI Live-Online	04 Dec - 08 Dec 2023