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SYSTEMS ENGINEERING NEWSLETTER

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Quotations to Open On

Tell me and I'll forget, show me and I may remember, involve me and I'll understand.

-- Chinese Proverb

Anyone who knows, and knows that he knows, makes the steed of intelligence leap over the vault of heaven.
Anyone who does not know, but knows that he does not know, can bring his lame little donkey to the destination nonetheless.
Anyone who does not know and does not know that he does not know is stuck forever in double ignorance.

-- Naser od-Din Tusi

Feature Article

Can a "Science" of Systems Contribute to Systems Engineering

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I am writing this as if it were an editorial or record of a dinner conversation between you and I rather than a formal journal article. That way, I can include a number of provocative positions, embarrassing or thorny sub-questions, controversies, insights, and caveats that come up whenever I have raised this question in the past[2]. You and I can expect not a single answer, but instead a number of observations and challenges that might sketch a more useful picture of the future than a simple yes or no.

The title question arises from a simple observation. Mechanical, electrical and aeronautical engineers take courses in physical science and mathematics in their preparation, and chemical engineers take courses in chemistry. Why don't systems engineers take courses in systems science?

An honest answer requires us to un-package the title into its many underlying and even more fundamental questions. What do we mean by "science" in this context? What is the relation between science and engineering such that engineers study science at all? Are there one or many Systems Sciences (SS)? In fact, is Systems Engineering (SE) itself one or many? Are all candidate systems theories based on science? If many, which systems science should we use to teach a systems core for SE? Has SE defined what depth and range of systems understanding it needs? What specifically could systems theories, extremely abstract as they are, contribute to practical applications like systems engineering? And very most important, what practical efforts can we do now to improve answers to all of these questions?

What Is "Science" in this context? Numerous new fields rush to add the word science to what they do. This is due more to the natural urge to share its status in society, gain its reputation for effectiveness, and secure similar high levels of funding, legitimacy, and recognition. Even in the long recognized sciences there is a pecking order. Physics, mathematics, and chemistry are widely recognized as the "hardest" in terms of "scienceness," ranging through astronomy, geology and biology. All sciences have gone through common histories of stages of achieving the ideal attributes of the scientific method. Astronomy, geology, and biology had long phases of what I would label pre-science, that is, "description," "identification," "naming," and "categorizing" (DINC) before they could progress to key features of the scientific method. These are (1) a theory or model of how things work synthesized from many past, integrated observations or verified mechanisms; (2) the formulation of clear and distinct answerable questions or predictions (from 1) as to how things work, best expressed as a set of alternative hypotheses (often expressed as alternative, measurable mechanisms); (3) experiments designed to eliminate hypotheses; (4) associated sets of controls and limits; (5) use of sophisticated tools of measurement that have proven correspondence principles; (6) sophisticated statistical analysis of results; and (7) strong coupling between elimination of some hypothetical alternatives and future cycles of questions to test or integration into the starting model or theory. These several attributes indicate that many things called science today by their proponents are not (design science, social science, management science, etc.). This statement will upset many folks, but we need to set a high bar with which to evaluate the phrase "a true science of systems."

In the context of the title question, many of the authors and contributors that call themselves systems scientists and their lifeworks are still in the initial stages of DINC. For systems science to truly become a “science” of systems, it has to attain the several key attributes of the scientific method. I would suggest that the portions of SS that are termed or derived from “natural systems science” are much closer to a true “science” of systems than many other system approaches. It is very important to note that we are not criticizing these other approaches but rather indicating their limitations in building a true science of systems course for engineering systems that mimics what physics or chemistry studies do for well-accepted engineering fields.

What is the relation between science and engineering such that engineers study science at all? In discussing these questions, I have noted that some engineers bristle over the claim that science and engineering are linked. It is true that engineering is a very distinct and differently purposed human pursuit. But it seems reasonable to suggest that one learns from the other; the best of engineering is founded on the best of science. Engineering involves “testing” and “experiment” as much as science. And I can tell you that the favor is returned. Where would modern science and biomedicine be without electron microscopes, MRIs, synchrotrons – a very long list of amazing instruments derived from engineering?

If you are an electrical engineer, you take a range of science courses that gave you a grounding in the magnificent synthesis of electromagnetic theory, but only to enable its many practical applications for engineering a vast range of technologies that work reliably. If systems engineering wants to contribute as reliably to a wide range of current crisis human needs as much as fields such as mechanical, aeronautical, space, and chemical engineering have accomplished in the past, it may well want to base its work more on natural systems science (NSS). My analysis of current SE preparation is that it is almost completely ignorant of the riches of natural systems science. Hopefully this and past discussions will show that natural systems science (NSS) [7,8,12] has the several attributes of a true science[15] and would bring the benefits of science to SEs future and much expanded range of praxis.

A relevant and current case study might be that of biomimicry[1] and bioengineering. This area is rapidly expanding with one website listing 1,500 examples of successful engineering solutions arising from study of how natural biological systems solved similar problems. Since the biological solutions arose from nature attempting a vast number of variations over literally millions of years and selecting some of the most “sufficing” solutions, nature has essentially “tested” many alternative solutions and eliminated many[15]. Nature has done a great deal of work for us; mimicking its results might be very efficient. Basing SE more on NSS may lead to a new, explosive growth area that might be called “systems mimicry.” More on this in practical group projects below.

Is Systems Engineering one or many? Problems arising from the inherent, multi-faceted nature of SE and SS: Systems Engineering and Systems Science appear to have suffered similar histories and fates. Samantha Brown of BAE Systems, immediate Past President of INCOSE (International Council on Systems Engineering), described no less than 16 specific reasons Systems Engineering was not as widely accepted as SEs think it should be in a keynote talk given at ISSS’11 (International Society for the Systems Science) in Hull, England. My experience as a systems scientist for 45 years indicates that the exact same [16] reasons explain why systems science is not as accepted as SSs think it should be. So how could a field facing the same obstacles (perhaps even more – in6, I cited 33) help a sister field?

Both SS and SE range across a vast diversity of very distinct applications areas. SE focuses on design, delivery and testing of natural, artificial, informational, physical, human, and hybrid systems of systems as well as management of very large-scale projects and simulations. Indeed, the increased recent sensitivity in SE to a possible need for SS arises from management of large projects faced by the military, aerospace industry, international economy, and law/politics. SS is interdisciplinary like SE, but goes beyond that to the transdisciplinary in that it tries to find what is universal or similar across the multitude of natural and human systems present in the world, in order to define the essence of how systems work. It tries to specify explicitly how “systemness” sustains itself and satisfies necessary functions. SS is also applied in that it tries to develop tools and techniques for humans to use to build, operate, diagnose, develop, and improve both artificial engineered products as well as human and social systems. Since the humans that build, operate, diagnose and develop the systems are organized into institutions, they themselves are “systems” in formation. Therefore management and efficiency of those human systems are subjects of both SE and SS. Clearly, both have similar needs and goals, but these are frustrated by the vast range of types of “systems” which they study and wish to attempt intervention. The major characteristic of both has been increased fragmentation and loss of cohesion as the anthill of humanity has added ever-increasing detail to all parts of the range of coverage.

A unified or integrated natural systems science would show how systems work in much greater detail, yielding many workbooks of proven solutions that real systems across the universe have achieved through 14+ billion years of incomprehensible numbers of events and at scales from 10-25 to 1055. [7,8,15] If the goal of SE is to make systems that work, it would seem that at least one year of study of natural systems science combined with coverage of human systems studies might produce systems engineers better equipped to accomplish their goals.

Are all candidate systems theories based on science? There is a plethora of un-integrated and fragmented sources of information for a science of systems[15]. One must study and synthesize: systems theories (Bertalanffy’s, Odum’s, Miller’s, Klir’s, Troncale’s and more); work on specific special features of systems (Lorenz’s, Abraham’s chaos,

Mandelbrot's fractals, Forrester's feedback dynamics, Prigogine's thermodynamics, Haken and Corning's synergies, Wilson's, Pattee's & Salthe's work on hierarchies, Kauffman's emergence, Barabasi's network theory, Ashby's, von Foerster's self-organization, Eigen's hypercycles, Bak's self-criticality, Thom's & Zeeman's catastrophe theory, and more); work on specific types of systems to the exclusion of others (biological, human, physical, Shannon's information-based, manufactured and more)[a 20 min brainstorming exercise at a recent workshop resulted in a listing of 97 different types of systems]; work on natural systems sciences (Mesarovic's, Hood's systems biology, Whiteside's systems chemistry, earth systems science, Troncale's systems pathology)[11]; work on complexity science (Cowan's, Gel Mann's and more); work by physicists at the theory-of-everything level not intended for systems research but containing much on systems (Auyung, Barrow,); work on systems methodologies (Zadeh's fuzzy math, Langton's artificial life, Holland's agent-based modeling, Meadows, and more); work on systems on various scales of size (astronomical, subatomic, Newtonian, ecological, world economic, world weather, Wilson's, West's allometry & Troncale's systems allometry); work on different domains of systems (Iberall''s, Wymore's, Weinberg's systems engineering, Capra's's or Lazlos' systems philosophy, Beer's, Checkland's, Warfield's, Ackoff's, Churchman's, Senge's systems management); chroniclers summarizing systems research history (Hammond, Francois, Skyttner) -- all have different purposes, emphases, and coverage. There is certainly a considerable and valuable set of products to harvest, integrate, synthesize and unify. And this list of nearly 50 workers is just off the top of my head. Some workers have charted relationships between many more distinct systems approaches or "lifeworks" on systems than these.

Only a small number of these have a firm basis in the natural sciences and can be studied with the scientific method. And even those do not study systems comprehensively as much as partially because they tend to focus on one discipline or cluster of disciplines such as earth systems science, systems biology, or systems chemistry or even a subspecialty such as systems immunology or systems neuroscience or on one scientific phenomenon or process, not how all the processes relevant effect each other using the scientific method. That is what a "science" of systems would be. That is the goal of the "system of systems processes theory" (SoSPT) described briefly below [3,4,5,13,14,15].

There are three major tasks to achieve to enable the teaching of a "science" of systems. First, there must be a comprehensive integration, or synthesis of these sources, especially the parts that have a basis in natural science, just like the great unification events of the past (a rigorous taxonomy in biology by Linnaeus culminating in Darwin's unified theory of evolution, or the synthesis of electromagnetism via Maxwell's equations, or the periodic table of elements by Mendeleev). Second, there must be a very organized, comprehensive campaign to "harvest" the vast natural science literature of proven experimental results to the new science of systems such that the results for particular phenomena, at different scales of inquiry are shown to elaborate the more abstract mechanisms of systemness. These results are proven for particular reductionist disciplines BUT their phenomena are actually also studies of the mechanics of "systemness" on the more abstract level only they have never been applied as such. Third, the integration of factual, reliable mechanisms must be strongly coupled with less scientific, but equally important aspects of SE practice like tools[10], techniques, and management applications to human teams and institutions.

What are the strengths and weaknesses of different systems approaches that would help us choose which systems science course to teach? As SE has such a wide range of applications and application domains, the science of systems that serves it should also represent a wide range of theory and useful guidelines. It does. While natural systems science might give us the result of nature's experiments with systems across the eons [15], it might not be the best place to find guidelines and techniques to help with small and large scale social systems made up of rather ornery and independent humans. Rather than the current state of antagonism between the soft systems methodology proponents and the scientists, we need a mutual respect for the uniquely different limits and opportunities of both major branches of systems study. They need to complement rather than provoke each other in the new synthesis and the new core courses for SE preparation.

One example. In my several papers on the isomorphic process/structure "hierarchy"[5] I noted that sometimes an isomorphy is actually discovered or manifested (most easily seen) in the human disciplines. While the social and political disciplines are rather far from science, they historically provided the first glimpse of the importance of hierarchy. Indeed, the word itself means "sacred" "ruler." Its characteristics mimic some of the features of natural systems (levels, subsumption, clustering, ranking, empirical regularities across levels, etc.). Studies in the natural sciences also reveal extensive hierarchical structure from the cosmos to your own body to subatomics. But the nature of the hierarchies in those systems yield different take-home lessons on the importance of hierarchy to the origins, maintenance, and sustainability of systems. And now the new field of network theory modifies that by showing that some networks and hierarchies are interchangeable (clustered or so-called scale-free networks). Thus, it is the combination of the views of the human disciplines, the science disciplines, and mathematics that gives us the most complete understanding of the systems function of hierarchy. And in turn that more detailed understanding (if it is as specific as how it works and what it does in terms of features, functions, and linkages) makes it more possible to use hierarchy to engineer better systems of all kinds.

The conclusion is that the diverse approaches to understanding systems is an overall strength if the various approaches are integrated and each is utilized for its strengths while complementing its weaknesses with the strengths of other approaches. This attitude would not only enable the hoped-for unification but stop the miscommunication and hostility between the approaches.

This note is too short to try to enumerate strengths and weaknesses of different approaches, but its intent is to call for a comparative systems analysis that would do just that. CSA would be another important step toward unification and a science of systems. It would indicate in which types of systems and which disciplines any particular isomorphy was dominant and functional. Such a road map would be very useful to practicing systems engineers.

Has Systems Engineering defined what depth and range of understanding of systems it needs? I detect no sustained effort until recently to accomplish this task. Recently INCOSE has initiated two Working Groups that may fulfill this first step: the Systems Science Working Group (James Martin) [our wiki site: https://sites.google.com/site/syssciwg/] and the Complex Systems Working Group (Sarah Sheard, Eric Honour). To date, INCOSE knowledge base and library initiatives present systems science in a comparatively shallow and non-robust manner, typically in mostly the systems management domain leaving natural systems science entirely uncovered. Treatment there is certainly not as comprehensive as advocated here.

We here also advocate a much broader field of applications for systems engineering of the future that will need this more highly specific understanding of systems. Even those paying for systems intervention and engineering will need to study SS to better prepare the performance specifications that control the systems that are innovated. The society that loses its power and facility to innovate dies. Many very large-scale SE projects are moving decisively to hybrid natural system-human system domains, international economics, international politics, military, pandemics, climate change, systems of systems – all will require a more detailed input of knowledge on how systems work. And before we know it SE will be called upon to perform even at the scale of planet-forming and assist other disciplines in the curation of massive natural systems. SEs of the future will become medical doctors of ailing systems of all kinds at all scales using studies of systems pathology. They will become the “curators” of systems of the future. Now is the time to help accomplish the integration of the fragmented systems approaches to meet this challenge.

What specifically could systems theories, extremely abstract as they are, contribute to practical applications like systems engineering? Although the essence of a “science” of systems…. finding the commonalities across a vast range of systems, absolutely requires several levels of abstraction from the particulars in order to “see” the similarities – the mechanisms that are similar are in the pattern of interactions among the particulars, not just the particulars – the expectation is that one could de-abstract from the patterns to apply them to any new set of particulars to achieve the same benefits for sustainable systems. Any of the equations used in aeronautics or mechanical engineering, or is space exploration etc. are themselves abstractions several levels from particulars. It is just that we are used to then reapplying them to exactly the same domain of particulars in much of current practice. A SS basis for SE would enable application to systems of other domains.

This presumes the above cited need for integration and synthesis of the currently fragmented literature into workbooks of proven potential mimicry for engineers. We envision some of the following outputs:

- Workbook of Proven Systems Processes (50 Isomorphies) [13]
- Workbook of System Process Interactions (the key to systemness) [14]
- Workbook of Proven Network Motif’s
- Workbook on Types of Non-Linear Causality and its Uses
- Workbook on Systems Pathologies [11]
- Workbook of Systems Mimicry
- Workbook of Management Guidelines

In my own work, I have focused on identifying the isomorphic processes proven to be similar across many natural systems from different disciplines, domains, techniques & tools, and scales (which I designate as DDTs, after the poison, because staying focused only on the particulars poisons seeing the similarities). In the System of Systems Processes Theory (SoSPT) [3,9,10,13,14] we have identified more than 105 such isomorphic processes, recently reduced to a list of 50[13]. Each such process has been shown in many different systems as a key contributor to its sustainability and function. Some, like feedbacks, are generally accepted as proven and are found in many systems workers theories. Others are quite unique. Still others are included, but their effects on each other, the key to systems function, are not specified. A major advance of the SoSPT is that such interactions where one systems process affects another, and therefore establishes how the systems work, are captured in explicit Linkage Propositions (LPs). The major advance proffered by the SoSPT is the specific mutual influences captured in the LPs[14]. We have literally 100’s of such LPs in the SoSPT. The result is a “theory,” on the “abstract” level, but which potentially provides many explicit guidelines, or design ideas for anyone engineering or trying to fix or improve many systems on many levels.

In answer to the original question of this note, we have tried to extend the "science" aspect of the SoSPT by "proving isomorphy," a step assumed and much neglected in the current un-integrated literature, but necessary to raise systems theory more to a level of science. For example, one current presentation and article[16] cites the natural science literature extensively by providing citations from 52 different case studies from….. 6 phenomena in astronomy, 8 phenomena in physics, 10 phenomena in chemistry, 6 phenomena in geology, 10 phenomena in biology, 7 phenomena in computer science, 4 phenomena in mathematics, and 9+ phenomena in human science….. where in each case the presence of the same 12 identifying features for putative isomorphy (systems process) "cycling or cycles or oscillations" are proven using the scientific method and experiments WITHIN the science or scale of each discipline. We suggest that is sufficient to "prove" an isomorphy across real systems and form the foundation for a true science of systems. We now only need to do this for the remaining 50 putative systems processes.

We do not have space in this short essay to elaborate on the SoSPT "spin-offs" from such an explicit integration of past systems work (systems allometry, systems pathology, systems science applied to law & legislation, theory of emergence). But the workbooks mentioned above, filled with direct citations and explanations of how each increases understanding of systemness would be a set of seven products that then could be used as part of the SE toolbox. Explicit understanding of systems-level pathologies[11] of motifs found in many networks, of the Linkage Propositions between systems processes, of the resulting types of non-linear causalities and how nature has actually used those unpredictabilities to make systems accomplish their function better – ALL might be useful the wider future practice of SE envisioned here.

What practical projects could we join to enable a "true" Science of Systems useful for Systems Engineering? So how do we get there from where we are now? Here are a dozen very practical efforts underway organized for your participation. Each has as its charter accomplishing portions of the tasks that must be completed to provide a firm foundation for a science of systems for systems engineering. Even joining to introduce challenges and criticism, or increase diversity of products by including your efforts in the area is important to improving the outcome. Do you want to be a part of this possible advancement for systems engineering? Contact the author (at lrtroncale (at) csupomona.edu) for more specifics or to add your name and contact information to project teams listed below

- Join INCOSE (International Council on Systems Engineering) Systems Science Working Group (SSWG) and its official project for Unifying Systems Theories. Go to www.incose.org or more specifically the project Wiki site at https://sites.google.com/site/syssciwg/
- Join INCOSE Systems Science Working Group (SSWG) and its official project on initiating the new field of top-down Systems Pathology. Go to www.incose.org. or more specifically the project Wiki site at https://sites.google.com/site/syssciwg/
- Join the International Society for the Systems Sciences (ISSS) and its Special Integration Groups (SIGs) on "Research Toward A General Theory of Systems" or on "Systems Pathology." Go to www.isss.org.
- Join a newly forming professional society, the International Society for Systems Pathology (ISSP). All professionals who join before January 2013 are designated as Founding Members.
- Attend INCOSE International Workshop 2013 in Jacksonville, Florida, January 26-29 which will have multiple session discussions on these topics. Also be aware of paper sessions and panels scheduled for regional INCOSE chapter meetings, especially those in California, and at the INCOSE annual International Symposium (Philadelphia, June 24-27 2013) on these topics.
- Join in the work of ongoing SoSPT professional teams devoted to advancing the above named Workbooks for each of the 50 systems processes, the Linkage Propositions, and SoSPT spin-offs such as Systems Pathology, Systems Allometry, Non-Linear Causalities, SoSPT-derived computer tools, Network Motif's, Theory of Emergence, and Applications to Law and Legislation.
- The author is part of a committee proposing a new M.S. Program in Systems Engineering at California State Polytechnic University (Cal Poly) College of Engineering. We are proposing to the committee that Cal Poly be the first Systems Engineering curriculum to offer a year-long course in Systems Science as part of the core. Become part of the study group measuring effectiveness.
- Suggest an article for an edited volume on "Systems Pathology," probably the first of its kind on the top-down systems-level version of pathologies. We need convincing case studies as chapters.
- Suggest an article for an edited volume on "Systems Mimicry," probably the first of its kind but modeled after several successful volumes on biomimicry. We need convincing case studies as chapters.
- Join and listen to Systems Radio, a new project including several interviews with its founder, SE Kent Palmer, and this author, but soon to be adding a series by three, systems-interested Nobel Laureates and those designated as

this author, but seem to be adding a series by three, systems interested Nobel Laureates and three designated as Founders of Systems Science by the Behavioral Science Foundation. Go to systemsradio.net

References

For reasons of space, a full set of references is not included. I have included only a few key references to my own work. Many references to other sources cited may be accessed in the Reference sections of these papers.

1. Allen, R., Ed. (2010) Bulletproof Feathers: How Science Uses Nature's Secrets to Design Cutting-Edge Technology. University of Chicago Press, Chicago, 192 pp. /OR/ Bar-Cohen, Y. Ed. (2006) Biomimetics: Biologically Inspired Technologies. CRC Taylor & Francis, N.Y., 527 pp. /OR/ Sarikaya, M. & I.A. Aksay (1995) Biomimetics: Design and Processing of Materials. AIP Press, American Institute of Physics, Woodbury, N.Y., 285 pp.

2. Sparber, J. & D. Latterman (2012) "A Report from the June Speaker Meeting: Can A "Science" of Systems Contribute to Systems Engineering." INCOSE-LA Newsletter, Vol.10: Issue No. 7, August, p. 4.

3. Troncale, L. (1978), "Linkage Propositions Between Fifty Principal Systems Concepts," in Applied General Systems Research: Recent Developments and Trends : N.A.T.O. Conference Series II. Systems Science (G. J. Klir, Ed.) Plenum Press, N.Y., pp. 29-52.

4. Troncale, L. (1982) "Linkage Propositions Between Systems Isomorphies" in A General Survey of Systems Methodology: Vol. I. Conceptual and Mathematical Tools (L.Troncale, Ed.) Intersystems Publ., Seaside, Ca., pp. 27-38.

5. Troncale, L. (1984) "A Hybrid Systems Method: Tests for Hierarchy and Links Between Isomorphs" in Progress In Cybernetics and Systems Research2 (R Trappl, ed.) North-Holland, NY, pp. 39-46.

6. Troncale, L. (1985) "The Future of General Systems Science: Obstacles, Potentials, Case Studies." 147 References. Systems Research Journal. Vol. 2(1): 43-84. Also reprinted with permission as a IIASA (International Institute for Applied Systems Analysis, Laxenburg, Austria) Working Paper, WP-85-21, May, 1985.

7. Troncale, L. (1986) "Knowing Natural Systems Enables Better Design of Man-Made Systems: The Linkage Proposition Model." in Power, Utopia and Society: New Approaches to Complex Systems. (R. Trappl, Ed.) Plenum Press, N.Y., pp. 43-

8. Troncale, L. (2001) "The Future of the Natural Systems Sciences" in (G. Ragsdell & J. Wilby, Ed.'s), Kluwer Academic/ Plenum Pub., N.Y., pp. 219-237.

9. Troncale, L. (2006), "Towards A Science of Systems" Systems Research and Behavioral Science, Special Issue on J.G. Miller, Founding Editor (G.A. Swanson, Ed.) 23(3): 301-321.

10. Troncale, L. (2011) "An Investigative Model of How Complex Systems Work: Artificial Systems Research Based on Natural Systems Science" in Proceedings of the Conference on Systems Engineering and Research, April 15 and 16, Redondo Beach, CA., Paper #46 (electronic proceedings).

11. Troncale, L. (2011) Would a Rigorous Knowledge Base in Systems Pathology Add Significantly to the SE Portfolio?" in Proceedings of the Conference on Systems Engineering and Research April 15 and 16, Redondo Beach, CA., Paper #47 (electronic proceedings).

12. Troncale, L. (2011) "Can a Theory that Integrates the Natural Systems Sciences Help Systems Engineering of Defense Against Security Threats?" in Proceedings of the Eighth International Conference on Information Technology: New Generations, Las Vegas, Nevada, April 11-13, IEEE Computer Sci Publ., pp. 947-952.

13. Friendshuh, L. & L. Troncale (2012) "SoSPT I.: "Identifying Fundamental Systems Processes for a General Theory of Systems (GTS)," in Proceedings of the 56th Annual Conference, International Society for the Systems Sciences, July 15-20, San Jose State Univ. (electronic proceedings: Go to http://journals.isss.org), 20 pp. [will be uploaded ~Nov'12]

14. McNamara, C. & L. Troncale (2012) "SoSPT II: How to Find & Map Linkage Propositions for a GTS from the Natural Sciences Literature," in Proceedings of the 56th Annual Conference, International Society for the Systems Sciences, July 15-20, San Jose State Univ. (electronic proceedings: Go to http://journals.isss.org), 25 pp. [will be uploaded ~Nov'12]

15. Troncale, L. (2011) INCOSE Webinar #28, February 16. "Relevance of Natural Systems Science to Systems Engineering: Intro to A New System of Systems Processes Theory." (rather than wading through the detailed INCOSE Website go directly to the link: http://bit.ly/gbX4Le)

16. Troncale, L. (2012) "Proving Isomorphy: Testing Cycles Across Disciplines, Domains, Tools and Scales," in

Proceedings of the 56th Annual Conference, International Society for the Systems Sciences, July 15-20, San Jose State Univ. (electronic proceedings: Go to http://journals.isss.org), 68 ppt slides [will be uploaded ~Nov'12]

Systems Engineering News

Safety Critical Mailing List

The safety-critical mailing list is a forum for discussion of the engineering and assessment of safety-critical systems, with special reference to computing. It covers safety requirements and risks, safety engineering techniques and safety assessment. Its focus is on safety-critical computer systems and computer-supported design and assessment of general system safety.

More information

NAFEMS and INCOSE Announce a Collaboration to Accelerate Innovation for Engineering Simulation and Model Based Systems Engineering

NAFEMS (formerly the National Agency for Finite Element Methods and Standards), an independent non-profit organization representing the international engineering analysis community, and the International Council on Systems Engineering (INCOSE) announce a joint relationship for mutual participation and collaboration for the advancement of engineering simulation and model based systems engineering. This collaboration includes the implementation of a joint cross organizational working group on Systems Modeling & Simulation. NAFEMS will launch a new international Technical Working Group (TWG) in concert with INCOSE to promote a deeper understanding of lifelike behavior to integrate mechanical analysis and simulation within their Model Based System Engineering initiative. Additionally, through this collaboration NAFEMS and INCOSE will provide mutual assistance and support for international standards and develop a joint approach for interfacing with other organizations in related professional areas. The memo of understanding (MOU) was signed by both organizations at the 22nd Annual INCOSE International Symposium (IS2012) held in Rome, Italy.

More information

Start Planning for IS2013

The 23rd Annual INCOSE International Symposium returns to USA - paper, panel and tutorial deadline is 8th November 2012.

IS2013 takes place in Philadelphia PA, 24-27 June 2013. For more information and Call for Papers, Panels, Tutorials visit the website:

www.incose.org/symp2013

Important dates:

- Initial submissions: 8th November 2012
- Author notification: 22nd February 2013
- Final submissions: 19th March 2013

More information

Jon Holt Valorizes MBSE With His Lecture "Making Houdini Safe"

MBSE meets STEM on Pythagoras' Trousers. The worlds of systems engineering and escapology overlap when Dr. Jon Holt puts his life on the line recreating and re-engineering.

Houdini 's classic upside down straitjacket escape, but on a burning rope! Jon demonstrates how rigorous engineering techniques can be applied to safety-critical systems (any system where people may be hurt if things go wrong) by performing this classic stunt. Jon has previously won awards for his original and innovative approaches to teaching and disseminating engineering best practice and this stunt shows his latest, and most spectacular, effort to date. Jon, a member of the INCOSE UK Chapter, previously delivered this lecture last year at the international MBSE conference at GMU. You can listen to this lecture now at:

http://www.rhysphillips.co.uk/pythagoras-trousers/the-pythagoras-lectures-series-1-episode-7/

Pythagoras' Trousers is a radio show from the South Wales Networks of the Institution of Engineering & Technology and Radio Cardiff. Each week, presenter Rhys Phillips takes a look at stories of interest from the worlds of science, technology, engineering and mathematics, bringing these fields to a wider audience and promoting these subject areas to school pupils.

More information

INCOSE Future of Energy Working Group

Dr. Alex Pavlak is setting up an INCOSE Future of Energy (FoE) Working Group. This Working Group will focus on whole systems, the delivery of energy that is cheap safe sustainable and secure. It will consider on the destination, the long term goal of proposing technically feasible alternatives. Through publications and lectures, the FoE working group will raise public awareness of these factual constraints on social value choices. If you are interested in participating, please email Dr. Pavlak at alex (at) pavlak.net.

More information

INCOSE Systems Engineering – Project Management (SE – PM) Working Group

Dave Fadeley, ESEP, is forming a Systems Engineering - Project Management (SE - PM) Working Group with the intent of working with PMI Baltimore chapter members in order to enhance overall program success through the improved integration of practices between the two communities. If you are interested in participating, please email Mr. Fadeley at dbfadeley (at) verizon.net.

More information

ISO/IEC JTC1 SC7 WG42 Survey of Architecture Frameworks

ISO/IEC JTC1 SC7 WG42 is collecting examples of architecture frameworks. A list of the 53 architectural frameworks identified to date, together with, for each, short Identifier, full name, purpose, scope, classifiers, and significant notes, is at http://www.iso-architecture.org/ieee-1471/afs/frameworks-table.html.

Corrections and additions are sought and may be sent to the WG42 webmaster at emery (at) grebyn.com. Please include: Name, Purpose, Scope, Brief Description and URL (or literature references).

NDIA/PSM System Development Performance Measurement Survey - Call for Participation

The USA NDIA Systems Engineering Effectiveness Committee of the NDIA Systems Engineering Division, along with Practical Software and Systems Measurement (PSM), recently completed a System Development Performance Measurement Report. This report recommends the use of nine leading indicators that provide insight into technical performance at major decision points for managing programs quantitatively across their life cycle. To guide further work, additional information on the degree of use currently as well as the perceived value of this indicator set is desired. Your organization's participation in a short web based survey would be very helpful to this effort. The survey is CONFIDENTIAL and ANONYMOUS. The responses will be analyzed in aggregate and the results will be published in a subsequent report and presented at the NDIA's 15th Annual Systems Engineering Conference in October, 2012.

The survey seeks the opinions from the role on the program that is primarily responsible for systems engineering related decisions, usually the lead systems engineer or chief engineer, although other roles like program manager or deputy program manager may be most suitable on a particular program. The best way for your organization to participate is to

program manager may be most suitable on a particular program. The best way for your organization to participate is to provide responses from multiple programs or projects that reflect typical systems engineering practice within your organization.

The Institute for Defense Analyses (IDA) is the "honest broker" which will host the survey and assure that it is confidential and anonymous. The survey response period closes on September 28th.

Please use the following link to participate: https://questionpro.com/t/AIuuJZOCnT

Institution of Engineering and Technology (IET) and INCOSE UK Drive First Movers Initiative

The UK Chapter of the International Council on Systems Engineering, INCOSE UK, and the Institution of Engineering and Technology (IET) have joined forces with seven of the UK's leading engineering and technology organizations to provide new options for developing career pathways in systems engineering.

Branded 1st Movers, this initiative builds upon the agreement signed last year between INCOSE UK and the IET, which established a new collaborative partnership route to professional registration as a Chartered Engineer for INCOSE UK members.

The organizations involved attended a successful 1st Movers Symposium event at IET London: Savoy Place on 7 June 2012, at which a charter was signed on the value of professional registration and continuing professional development.

Alan Harding, the Systems Engineering Process Manager at BAE, said: "Systems engineering is critical to companies like BAE Systems and the others here today. This initiative is a valuable step towards developing and retaining the top class engineers we all need."

More information

Ask Robert

Question: What is a systems engineer and how does it differ from a design engineer?
I am now getting rather nervous, because mostly when I explain what a systems engineer does, the eyes glaze over and the short summery is, ok it is similar to a design engineer, which I believe is not the case.

Answer: I very rarely use the term "systems engineer", not because there is anything wrong with the term, but it is not very useful. But I do use the term "systems engineering" quite a lot. I do not know a single individual who is expert in all of the process areas and methods within systems engineering. I do know thousands of engineers who practice aspects of systems engineering. By systems engineering, I mean "a systems approach to the engineering of systems". Many (most) of these engineers are design engineers, i.e. engineers who make solution decisions.

As far as systems engineer as a job title, it is OK, but it can mean pretty much anything:

- somebody who worries only about requirements
- a process policeman who doesn't have the technology knowledge to engineer anything, but tells the technologists what they should do
- a system architect
- somebody who only plans, organizes, checks and controls the engineering, but doesn't do the engineering
- an experienced engineer who integrates the technical contributions from technologists of various persuasions, focusing on interfaces, traceabilities, design integrity, verification, validation
- somebody who engineers a system
- somebody who performs one or more of Sarah Sheard's "Twelve Systems Engineering Roles", published in the INCOSE International Symposium Proceedings of 1996.

I regard it as important that all engineers, including design engineers, have a base level of systems engineering

I regard it as important that all engineers, including design engineers, have a base level of systems engineering understanding and skills. For design engineers, I regard it as important that they have, in addition, considerable depth in the principles and methods of a systems approach to design, complementing their relevant technology knowledge. Does that make them systems engineers? In my view, the answer does not matter much.

Robert Halligan, FIE Aust
Managing Director, Project Performance International

Reflections on Robert's Reflections

Systems of Autonomously Managed Systems

In the last edition of SyEN I drew attention to the rampant confusion existing over the terms "System of Systems" and "System of Systems Engineering". My remedy has been to use the terms "System's of Autonomously Managed Systems (SOAMS)" and "System's of Autonomously Managed Systems Engineering (SOAMSE)" as alternatives.

The piece drew two thoughtful responses which the respondents have agreed to share with SyEN readers.

Robert Schaaf said: "I agree with you that the time has come to address the rampant confusion over the terms SoS and SoSE. With due respect, I disagree that the terms need to be replaced. Instead, my advice is to drop the terms altogether as their use shows a lack of understanding of the concepts of system and systems engineering. To wit, the concept of system includes the idea that a system consists of parts and that a part may be a system. It follows that the engineering of a system may entail (in general entails) the consideration of multiple systems, albeit that each system minus one is nested in one (or more) of the multiple systems. In other words, for the same reason that we speak of systems engineering as opposed to system engineering, we should drop the use of the SoS and SoSE terms."

Dr. Todd Haynes said: "I read your recent "Robert's Reflections" and I must say I feel your pain. We have struggled for years with terms like SoSE and FoSE, as have so many other systems engineering organizations. Since you've opened the floor for suggestions, I wanted to bounce a couple of thoughts off of you. I agree that the excessive generalization of the term System of Systems, along with the increasing complexity of what we now view as the simplest, or perhaps most common, of devices renders that term essentially useless to us. Recent programs I've been involved in have used "Family of Systems", but this carries a connotation of commonality between the member systems, a genetic similarity if you will, that only accurately describes a narrow subset of complex systems. I like the direction you are going with "SOAMS", but I share your discomfort with the unwieldiness of it.

When I read your article and began to think of the member systems in terms of their ability to function and contribute independently, it occurred to me that when they operate together, it's as much about the purpose they are working towards as it is about their union. Since they have independent existence and management, the primary relevance of their union is functional, not structural. The amalgamation of systems is what it is because the members "came together" for a new purpose. That image led me to the term "Community of Systems". Communities are formed by individuals to accomplish goals that they cannot accomplish alone, with unique organizational structures focused on the purpose of the community, but designed not to impede progress against individual purposes.

For related terms, "sub-system" is another overloaded term, and can imply hierarchies that aren't present. "Member systems" come to mind, but seems unwieldy as well. The term I finally settled on is "co-systems". It's short, simple, and it implies membership without necessarily implying structure. Likewise, "co-operations" performed by and between co-systems seems appropriately descriptive, plus it has a nice ring to it from the perspective of independent entities working together."

Featured Society

The Institute of Mathematics and its Applications (IMA)

The Institute of Mathematics and its Applications (IMA) exists to support the advancement of mathematical knowledge and its applications and to promote and enhance mathematical culture in the United Kingdom and elsewhere, for the

public good. It is the professional and learned society for qualified and practicing mathematicians, with a membership of around 5,000 comprising of mathematicians from all sectors, as well as others with an interest in mathematics. The operational control of the Institute is through the Executive Board. Branches throughout the UK regularly hold talks by respected mathematicians, usually without charge, which are open to members and non-members.

Systems and Control Theory Group

Systems and control theory is an active area within the Institute, with many conferences and the publication of the IMA Journal of Mathematical Control and Information. The IMA Systems and Control Theory Group aims to improve the visibility of the field, contribute to its development, and to promote general interest in the area.

Numerical Analysis Group

The Numerical Analysis Group communicates via a newsletter. The University of Greenwich runs the Computational Science and Engineering Group for the IMA. This group also has a publication which you can sign up for via their website.

The Institute has a significant professional dimension, maintained and developed by the Professional Affairs Committee. Professional Affairs within the Institute have been concerned with Initial and Continuing Professional Development, the development of chartered designations and improving IMA links with and services to industrial and commercial organizations.

More information

INCOSE Technical Operations

INCOSE UK Systems Engineering Competencies Working Group

Contributing Organizations

The INCOSE UK Chapter's 'Systems Engineering Competencies Framework' (Phase 1 Working Group) and 'Guide to Competency Evaluation' (Phase 2 Working Group) were produced from the output of a number of workshops which included representation from the following organizations:

- BAE Systems
- EADS Astrium
- General Dynamics United Kingdom Limited
- Loughborough University
- Ministry of Defence
- Thales
- Ultra Electronics
- University College London.

Reason for Development

The Systems Engineering Competency Framework and Guidelines documents were developed in response to an issue identified by the INCOSE UK Advisory Board (UKAB). UKAB organizations wanted a common language with which to describe and discuss the competencies that are required to conduct good systems engineering.

The objective determined by the INCOSE UKAB was 'to have a measurable set of competencies for systems engineering which will achieve national recognition and will be useful to the enterprises represented by the UKAB'.

It should be noted that the competency framework does require tailoring to meet the needs of individual enterprises and the focus of the document is on the Competencies of Systems Engineering rather than the Competencies of a Systems Engineer.

The systems engineering competencies developed are based on the following systems engineering standards:

- International Organization for Standardization ISO/IEC 15288
- Capability Maturity Model Integration (CMMI)
- EIA 731
- INCOSE Systems Engineering Body of Knowledge & Handbook
- NASA Handbook
- IEE/BCS Safety Competency Guidelines.

The Guide to Competency Evaluation is designed as a companion to the Systems Engineering Competencies Framework document. It gives guidance on how to evaluate people against the competencies framework.

The Systems Engineering Competency Framework and Guide to Competency Evaluation are proving very useful to UK industry and academia.

Many organizations have tailored the framework and are actively using it to:

- Identify individual's and the organization's competencies in systems engineering;
- Identify learning and development opportunities;
- Select teams;
- Standardize job roles and descriptions;
- Aid recruitment and direct interview questions; and
- Develop systems engineering training.

Current/Future Activity

Work is currently underway (Phase 3 Working Group) to update both the Systems Engineering Competencies Framework and the Guide to Competency Evaluation, with feedback received through use.

More information

Systems Engineering Tools News

MapleSim 6 Released

Desktop Scientific has announced the release of MapleSim 6. MapleSim provides an approach to physical modeling, aimed at reducing model development and analysis time while producing fast, high-fidelity simulations. It is a "white-box" Modelica platform, giving flexibility and openness for complex multidomain models. MapleSim is based on the open standard Modelica modeling language for describing physical models and components.

More information

ABACUS 4.0 Certified Against ArchiMate

ABACUS is a flexible, cost-effective, feature-rich and easy-to-use I.T. strategy, planning and enterprise modeling tool, according to its developer, Australian company Avolution Pty Ltd. The latest release of this enterprise modeling solution has been certified against The Open Group's standard, ArchiMate® 2.0.

The ArchiMate standard defines a common language for describing the construction and operation of business processes, organizational structures, information flows, IT systems, and technical infrastructure, and supports the use of Enterprise Modeling tools such as ABACUS in the design, assessment, and communication of the consequences of decisions and changes within and between these business domains.

ABACUS 4.0 is also certified against the latest Open Group Architecture Framework, TOGAF 9.1, and is said to be the only tool to be certified against both Open Group standards.

Dr. Tim O'Neill, founder of Avolution, said “Organizations needing to base their Enterprise or Solution Architectures on ArchiMate can confidently utilize ABACUS 4.0”.

In addition to ArchiMate and TOGAF, ABACUS also supports more than 100 other industry frameworks and notations out-of-the-box, including; DoDAF/MoDAF, FEAF, PEAF, BPMN and UML. ABACUS's ontological approach means that meta-models are very easily modified or created, according to Avolution.

More information

IBM Announces DOORS Next Generation Beta 4

IBM has announced the availability of DOORS Next Generation Beta 4. This is the fourth (and likely final) beta download before the product is made generally available at the end of the year. DOORS Next Generation beta 4 is said to contain over 50 new features as well as significant improvements in stability and performance. Areas of improvement include:

- Locking;
- Link creation;
- ReqIF improvements; and
- Module editing enhancements.

More information

Release of SEER for Software (SEER-SEM) in September

Highlights of SEER-SEM version 8.1 include:

- New Size Growth Factor Parameters;
- Project Monitor & Control (PMC) Enhancements;
- Proxy Enhancements;
- New Knowledge Bases and New Languages;
- Updated Language Factors and New Language Table Selection Option; and
- SEER Enterprise Database (SEER-DB) Enhancements.

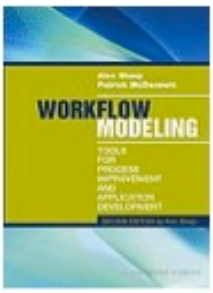
More information

Systems Engineering Books, Reports, Articles and Papers

Workflow Modeling: Tools for Process Improvement and Application Development, 2nd

Workflow Modeling: Tools for Process Improvement and Application Development, 2nd Edition

A. Sharp and P. McDermott



ISBN: 9781596931930

Format: Hardcover

Publication Date: October 2008

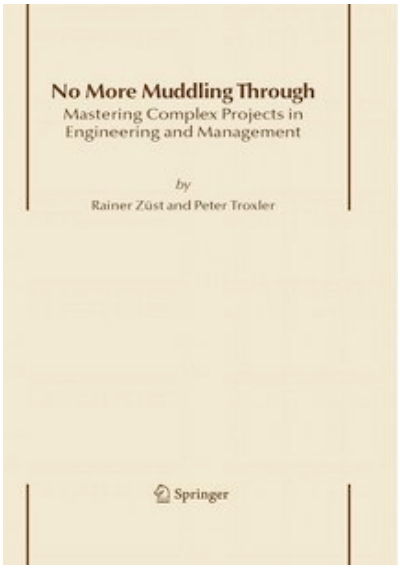
Book Description (From Powells web site):

Providing proven techniques for identifying, modeling, and redesigning business processes, and explaining how to implement workflow improvement, this book helps you define requirements for systems development or systems acquisition. By showing you how to build visual models for illustrating workflow, the authors help you to assess your current business processes and see where process improvement and systems development can take place.

More Information

No More Muddling Through: Mastering Complex Projects in Engineering and Management

R. Züst and P. Troxler



ISBN: 9781402050176

Format: Hardcover

Publication Date: September 2006

Book Description (From Springer web site):

Sustainable solutions require the integration of social and ecological aspects in every planning and decision-making process. This means: analyze the real world and model the problem situation as a system; understand the needs and

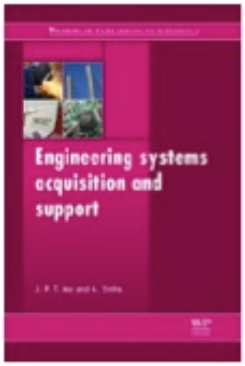
process. This means: analyze the real world and model the problem-situation as a system, understand the needs and objectives of the customers and clients; carefully develop alternative ideas and solutions, as well as evaluate concepts under multidimensional aspects/criteria. In this area Systems Engineering could offer a fruitful approach. Systems Engineering (SE) is a systematic way of thinking and a methodology to guide demanding problem-solving processes in the fields of management and engineering.

This book explains the most important principles and elements of Systems Engineering and three planning cases demonstrate the practical application.

More Information:

Engineering Systems Acquisition and Support

J.P.T. Mo and A. Sinha



ISBN: 9780857092120

Format: Hardcover

Publication Date: September 2013

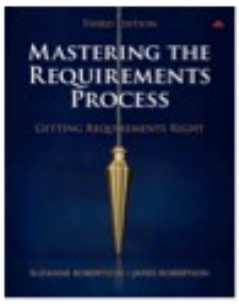
Book Description (From Amazon web site):

Engineering systems such as an aircraft or frigate are highly complex and specifically designed to meet the customer's requirements. This important book provides the information necessary to acquire and support complex engineering systems expected to last for a long time. Chapters in the first half of the book examine the life cycles of these systems, their design, testing and certification, and the principles behind their acquisition. The latter half of the book reviews topics including operations support and logistics, systems maintenance, reliability and upgrades, and performance and risk analysis, ending with a discussion of the need for continuous improvements in these systems.

More information

Mastering the Requirements Process: Getting Requirements Right, 3rd Edition

S. Robertson and J. Robertson



ISBN: 9780321815743

Format: Hardcover

Publication Date: August 2012

Book Description (From Amazon web site):

Software can solve almost any problem. The trick is knowing what the problem is. With about half of all software errors originating in the requirements activity, it is clear that a better understanding of the problem is needed.

Getting the requirements right is crucial if we are to build systems that best meet our needs. We know, beyond doubt, that the right requirements produce an end result that is as innovative and beneficial as it can be, and that system development is both effective and efficient.

New features include:

- Strategy guides for different environments, including outsourcing:
- Strategies for gathering and implementing requirements for iterative releases:
- “Thinking above the line” to find the real problem:
- How to move from requirements to finding the right solution:
- The Brown Cow model for clearer viewpoints of the system:
- Using story cards as requirements:
- Using the Volere Knowledge Model to help record and communicate requirements; and
- Fundamental truths about requirements and system development.

More information

Verification and Validation in Systems Engineering: Assessing UML/SysML Design Models

M. Debbabi, F. Hassaïne, Y. Jarraya, A. Soeanu and L. Alawneh

ISBN: 9783642152276

Format: Hardcover

Publication Date: November 2010

Book Description (From Amazon web site):

Verification and validation represents an important process used for the quality assessment of engineered systems and their compliance with the requirements established at the beginning of or during the development cycle. Debbabi and his coauthors investigate methodologies and techniques that can be employed for the automatic verification and validation of systems engineering design models expressed in standardized modeling languages. Their presentation includes a bird’s eye view of the most prominent modeling languages for software and systems engineering, namely the Unified Modeling Language (UML) and the more recent Systems Modeling Language (SysML). Moreover, it elaborates on a number of quantitative and qualitative techniques that synergistically combine automatic verification techniques, program analysis

quantitative and qualitative techniques that synergistically combine automatic verification techniques, program analysis,

and software engineering quantitative methods applicable to design models described in these modeling languages. Each of these techniques is additionally explained using a case study highlighting the process, its results, and resulting changes in the system design. Researchers in academia and industry as well as students specializing in software and systems engineering will find here an overview of state-of-the-art validation and verification techniques. Due to their close association with the UML standard, the presented approaches are also applicable to industrial software development.

More information

How 'Systems Thinking' is Making the Cloud Transparent

James Urquhart

This article at gigaom.com looks at systems thinking and IT.

"Given my current obsession with understanding everything I can about how cloud computing is beginning to look, feel and behave like a variety of other complex adaptive systems, I've started paying close attention to the widespread practice (outside of IT, it seems) of systems thinking.

Defined in Wikipedia as "the process of understanding how things influence one another within a whole," systems thinking represents a modeling, analysis and design discipline that carefully explores "macro" aspects of highly interdependent systems. Systems thinking is heavily utilized in such fields as the social sciences, organizational dynamics, and industrial engineering to evaluate, model, and/or design how systems are composed and how they behave.

Systems thinking is difficult for those that have been educated to always apply reductionist thinking to problem solving. The idea in systems thinking is not to drill down to a root cause or a fundamental principle, but instead to continuously expand your knowledge about the system as a whole."

More Information

Systems Engineering Journal Online (Wiley)

Table of contents for volume 15, issue 3:

- Managing software development information in global configuration management activities
- Constructing an SOA-based model for integrating design-centric Internet-mediated product information
- Problem management process, filling the gap in the systems engineering processes between the risk and opportunity processes
- Diogenes, a process for identifying unintended consequences
- Systems engineering of Omid, the first domestic satellite of the I.R. of Iran
- A proposed meta-model for formalizing systems engineering knowledge, based on functional architectural patterns
- Modeling complex systems of systems with Phantom System Models
- Elegant systems design: Creative fusion of simplicity and power
- Using a TRIZ framework for systems engineering trade studies.

More Information

Systems Engineering Journal Online (Wiley) – Early View

Systems Engineering Journal Online (Wiley) – Early View is a content alert for early view articles (an online version of record published before inclusion in an issue) available on the Wiley Online Library:

- A framework for benchmarking competency assessment models

- An agent-based simulation model of human-robot team performance in military environments
- An ontological framework for clarifying flexibility-related terminology via literature survey
- First steps in the development of a program organizational architectural framework (POAF)
- Evaluating deep uncertainties in strategic priority-setting with an application to facility energy investments
- Contracting processes and structures for systems-of-systems acquisition
- On principles and rules in complex adaptive systems: A financial system case study
- Budget-constrained portfolio trades using multi-objective optimization
- Predictive mental workload modeling for semiautonomous system design: Implications for systems of systems
- Performance-based logistics and technology refreshment programs: Bridging the operational-life performance capability gap in the Spanish F-100 frigates
- Practical experiences of model-based development: Case studies from the Swedish Armed Forces
- Interpreting “systems architecting”
- Designing offshore fish cages using systems engineering principles.

More Information

Special Issue of the International Journal of System of Systems Engineering

This is a special issue on emerging system of systems engineering, looking at research and application challenges.

More information

Conferences and Meetings

20th IEEE International Requirements Engineering Conference
September 24 - 28, 2012, Chicago, IL, USA
More information

CLAIO XVI – 16th Conference of the Latin-American Association of Operations Research
September 24 - 28, 2012, Rio de Janeiro, Brazil
More information

20th International Requirements Engineering Conference (RE 2012)
September 24 - 28, 2012, Chicago, Illinois, USA
More information

SAFECOMP 2012
September 25 – 28, 2012, Magdeburg, Germany
More information

2nd Requirements Symposium
September 27, 2012, Berlin

MODELS 2012, ACM/IEEE 15th International Conference on Model-Driven Engineering Language & Systems - Call for Papers - Deadline 19 March 2012
September 30 - October 5, 2012 – Innsbruck, Austria
More Information

SAM Workshop 2012

October 1 – 2, 2012, Innsbruck, Austria
More information

6th INCOSE Annual Great Lakes Regional Conference 2012
October 12 – 13, 2012, Schaumburg, Illinois, U.S.A
More information

World Engineering Education Forum (WEEF12)
October 15 - 18, 2012, Buenos Aires, Argentina
More information

19th Working Conference on Reverse Engineering
October 15 - 18, 2012, Kingston, Ontario, Canada
More information

ASME 2012 Dynamic Systems and Control Conference (DSCC2012)
October 16 - 20, 2012, Ft. Lauderdale FL , USA
More information

5th International Workshop on Systems & Concurrent Engineering for Space Applications SECESA 2012 NEW
October 17-19, 2012, Lisbon, Portugal
More information

27th International Forum on COCOMO and Systems/Software Cost Modeling
October 16 -18, 2012, Software Engineering Institute, Pittsburgh, PA, USA
More information

2012 International Annual Conference of the American Society for Engineering Management, Agile Management
October 17 - 20, 2012, Virginia Beach, VA, USA
More information

ESM'2012 26th Annual European Simulation and Modelling Conference
October 22 - 24, 2012, Essen, Germany
More information

Human Factors and Ergonomics Society HFES 2012 Annual Meeting
October 22 - 26, 2012, Boston, MA, USA
More information

ICSSEA 2012
October 23 - 25, 2012, Paris, France
More information

2012 Canadian Society of Value Analysis (CSVA) Annual Conference
October 24 - 25, 2012, Calgary, Alberta
More information

9th Workshop on System Testing and Validation Conducted in association with ICSSEA2012
October 24, 2012, Paris, France
More information

The World Congress on Engineering and Computer Science 2012
October 24 - 26, 2012, San Francisco, USA
More information

8º Congresso Brasileiro de Sistemas
October 25 - 26, 2012, campus da PUC Minas em Poços de Caldas, MG, Brasil
More information

The 19th International Conference on Industrial Engineering and Engineering Management
October 27 - 29, 2012, ChangSha, China
More information

Building Business Capabilities (BBC) 2012

October 28 - November 2, 2012, Fort Lauderdale, FL, USA

More information

International Conference on Complex Systems (ICCS'12)
November 5 - 6, 2012, Agadir, Morocco
More information

Physics-Based Modeling In Design & Development for U.S. Defense Conference NEW
November 5 - 8, 2012, Denver, CO, USA
More information

12th Annual CMMI Technology Conference and User Group
November 5 – 8, 2012, Denver, USA
More information

INCOSE UK Annual Systems Engineering Conference 2012
November 7 - 8, 2012, London, UK
More information

Systems Engineering Day 2012 (TdSE 2012)
November 7 - 9, 2012, Paderborn, Heinz Nixdorf Museums Forum, Germany.
More information

14th International Conference on Formal Engineering Methods (ICFEM 2012)
November 12 - 16, 2012, Kyoto Research Park, Kyoto, Japan
More information

Complex Adaptive Systems Conference
November 14 – 16, 2012, Washington D.C., Dulles, USA
More information

3rd International Conference on Complex Systems Design & Management (CSD&M 2012)
December 12 - 14, 2012, Cité Internationale Universitaire, Paris (France)
More information

PapersModel Based Systems Engineering 2012 Symposium
November 27 – 28, 2012, Edinburgh, South Australia

Operations Research Society of New Zealand (ORSNZ) Conference Includes a Systems stream: 'Systems Thinking, Systems Modelling and Systems Practice' NEW
December, 10 - 11, 2012, Wellington, New Zealand
More information

MESM'2012 The 13th annual International Middle Eastern Simulation and Modelling Conference NEW
December 10 - 12, 2012, Muscat, Oman
More information

IEEE 2012 International Conference on Industrial Engineering and Engineering Management NEW
December 10 - 13, 2012, Hong Kong
More information

INCOSE International Workshop IW2013
January 26 - 29, 2013, Jacksonville, Florida USA
More information

Conference Digital Enterprise Design & Management (DED&M 2013)
February 11 - 12, 2013, Paris, France
More information

International Symposium on Engineering Secure Software and Systems (ESSoS)
February 27 – March 3, 2013, Paris, France
More information

Integrated-EA Conference NEW

March 4 - 6 2013, London, United Kingdom

More information

INCOSE IL 2013
March 5 – 6, 2013, Daniel Hotel Herzlia
More information

ASTEC 2013, Asian Simulation Technology Conference NEW
March 7 - 9, 2013, Shanghai, China
More information

2013 INCOSE LA Mini-Conference
March 16, 2013, Los Angeles, CA, USA
More Information

The Requirements Engineering Track - 6th Edition at The 28th Annual ACM Symposium on Applied Computing (SAC 2013)
March 18 - 22, 2013, Coimbra, Portugal
More information

11th Annual Conference on Systems Engineering Research (CSER 2013)
March 19 – 22, 2013, Atlanta, Georgia, USA
More information

EMO 2013 - the 7th International Conference on Evolutionary Multi-Criterion Optimization NEW
March 19 - 22, 2013, Sheffield, UK
More information

Spring Simulation Multi-Conference (SpringSim'13) NEW
April 7 - 10, 2013, San Diego, CA, USA
More information

3rd International Workshop on Model-driven Approaches for Simulation Engineering NEW
part of the Symposium on Theory of Modeling and Simulation (SCS SpringSim 2013)
April 7-10, 2013, San Diego, CA, USA
Call for Papers closes November 1, 2012
More information

YoungOR 18 NEW
April 9 – 11, 2013, University of Exeter, Exeter, Unoted Kingdom
More information

International Conference on Manufacturing Systems Engineering (ICMSE 2013) NEW
April 14 - 15, 2013, Venice, Italy
More information

ECEC'2013, 20th European Concurrent Engineering Conference NEW
April 15 - 17, 2013, Lincoln, United Kingdom
More information

SysCon 2013
April 15 - 18, 2013, Orlando, FL, USA
More information

SETE 2013
April 29 – May 1, 2013, Canberra, ACT, Australia

ISC'2013, 11th Annual Industrial Simulation Conference
May 22 - 24, 2013, Ghent, Belgium

KIM2013 Knowledge and Information Management Conference NEW
June, 4 - 5, 2013, Meriden, United Kingdom
More information

13th International Conference on Process Improvement and Capability dEtermination (SPICE) NEW
4 - 6 June, 2013, University of Bremen, Germany
More information

81st MORS (Military Operations Research Society) Symposium NEW
June 17 - 20, 2013, United States Military Academy in West Point, NY, USA
More information

ASEE 120th Annual Conference & Exposition NEW
June 23 - 26, 2013, Atlanta, Georgia, USA
More information

12th International Symposium of the Analytic Hierarchy Process/Analytic Network Process (ISAHP 2013) NEW
June 23 – 26, 2013, Kuala Lumpur, Malaysia
More information

IS 2013 – Philadelphia
June 24 – 27, 2013, Philadelphia, Pennyslvania USA
More information

ISSS 2013: The 57th World Conference of the International Society for the Systems Sciences NEW
July 14 – 19, 2013, Hai Phong City, Viet Nam
More information

15th International Conference on Human-Computer Interaction 2013 (HCI International 2013) NEW
July 21 – 26, 2013, Las Vegas, Nevada, USA
Incorporating:
10th International Conference on Engineering Psychology and Cognitive Ergonomics
7th International Conference on Universal Access in Human-Computer Interaction
5th International Conference on Virtual, Augmented and Mixed Reality
5th International Conference on Cross-Cultural Design
5th International Conference on Online Communities and Social Computing
7th International Conference on Augmented Cognition
4th International Conference on Digital Human Modeling and applications in Health, Safety, Ergonomics and Risk Management
2nd International Conference on Design, User Experience and Usability
1st International Conference on Distributed, Ambient and Pervasive Interactions
1st International Conference on Human Aspects of Information Security, Privacy and Trust
More information

The Sixteenth SDL FORUM - SDL2013 NEW
Date and location to be determined, 2013
More information

ASME 2013 International Design Engineering Technical Conference and Computers and Information in Engineering Conference (IDETC/CIE2013)
August 4 - 7, 2013, location TBA, USA
More information

OR55 Annual Conference of the OR Society NEW
September 3 - 5, 2013, Exeter University, Exeter, United Kingdom
More information

International Conference on Operations Research NEW
September 3 - 6, 2013, Rotterdam, The Netherlands
More information

APCOSE 2013
September 9 - 11, 2013, Keio University in Japan
More information

SIMEX'2013

September 10 - 13, 2013, Brussels, Belgium

27th European Simulation and Modelling Conference - ESM'2013 NEW
October 2013, Lancaster, UK
More information

ASTEC 2014
March 2014, Digipen Institute of Technology, Singapore

ISC'2014
June 11 - 13, 2014, Skövde, Sweden

19th World Congress of the International Federation of Automatic Control (IFAC 2014)
August 24 - 29, 2014, Cape Town, South Africa
More information

SIMEX'2014
September 2014, Brussels, Belgium

INCOSE Europe, Middle East & Africa (EMEA) Sector: 1st EMEA Systems Engineering Conference 2014 (formerly EuSEC)
October 2014, Cape Town, South Africa

ASTEC'2015, Asian Simulation Technology Conference
March 2015, Japan

ISC'2015 13th Annual Industrial Simulation Conference
June 2015, St.Petersburg, Russia

SIMEX'2015
September 2015, Brussels, Belgium

ISC'2016 14th Annual Industrial Simulation Conference
June 2016, Bucharest, Romania

Education and Academia

The High Integrity Systems Engineering Group (HISE), University of York

The High Integrity Systems Engineering Group (HISE) undertakes research and teaching in all aspects of high-integrity computer-based systems, particularly real-time safety-critical systems and secure information systems. HISE is part of the Department of Computer Science at the University of York, United Kingdom. The broad aim of its work is to build a coherent set of methods and tools for the development and assessment of high-integrity systems and to achieve transfer of this technology into industry. It receives sponsorship from a variety of government sources - including DTI, the EPSRC, the European Commission the MOD, NASA, the Royal Society and the US Army Research Labs. Research support also comes from European industry - most notably Airbus, BAE SYSTEMS, QinetiQ and Rolls-Royce plc. HISE also have a wide network of collaborators and partners, involving groups from Universities and research labs around the world.

Research in HISE focuses on a range of topics in the systems and software engineering, safety and security. Current research activities include:

- Systems and Software Architecture, especially for embedded control systems
- Requirements Engineering
- Product Line Development, especially for embedded systems
- Formal System and Software Development, including formal development of control systems
- Development and Assessment of Integrated Modular Avionics
- Test Automation

- Safety Analysis for Systems of Systems
- Failure Modeling for Complex Multi-Technology Systems
- Development and Assessment of Safety Cases and Dependability Cases
- Risk and Trust-based Security Management for Networked Systems
- Unification of Safety and Security.

HISE is a key contributor to the Circus project. Circus combines Z and CSP with a refinement calculus to support development of state-rich reactive systems. The development of Circus started in 2000 as a result of collaborative work with the Universidade Federal de Pernambuco, Brazil. Since, then we have had the enthusiastic support of many collaborators from around the world (Ireland, Macau, Brazil) and from British industry. Together, we have investigated both the theoretical underpinnings of integrated refinement languages and its applications. QinetiQ supports the Circus project as an industrial collaborator.

HISE's teaching falls into two strands. HISE is responsible for the University-based MSc Programme in Safety Critical Systems Engineering, which provides students with a thorough grounding in theoretical principles and state-of-the-art techniques for the design, development and verification of safety-critical systems. In the past ten years, the MSc has attracted over 1,000 students from over 60 companies. More recently HISE has started a specialist MSc in Gas Turbine Control (GTC) for Goodrich and Rolls-Royce. It also provides a series of on-site courses in Safety and Hazard Analysis for industrial customers.

More information

MIT System Design and Management Program Systems Thinking Webinar Series

The USA Massachusetts Institute of Technology (MIT) System Design and Management Program Systems Thinking Webinar Series features research conducted by SDM faculty, alumni, students, and industry partners. The series is designed to disseminate information on how to employ systems thinking to address engineering, management, and socio-political components of complex challenges. SDM is the MIT Masters‘s Program in Engineering and Management. The webinars are free and open to all.

More information

Engineering Programs Receive ABET Accreditation

The Liberty University School of Engineering and Computational Sciences has announced this week that it has received accreditation from the Accreditation Board for Engineering and Technology (ABET) for its Electrical Engineering and Industrial & Systems Engineering programs.

ABET is the recognized accreditor of in the United States of college and university programs in applied science, computing, engineering, and engineering technology.

More information

University of Connecticut (USA) - Assistant/Associate/Full Professors Positions

The Electrical and Computer Engineering (ECE) Department solicits applications for two tenure-track faculty positions to conduct research, teach and outreach related to Systems Engineering for Advanced Manufacturing, with a focus on data and design infrastructure optimization, agile processes and smart manufacturing technologies.

More information

WPI and INCOSE Sign Certification Agreement

Worcester Polytechnic Institute (WPI) signed a memorandum of agreement with the International Council on Systems Engineering (INCOSE) at the 22nd Annual INCOSE International Symposium in Rome last month. This will allow the

university to assist its students and alumni of the MS and graduate certificate in Systems Engineering with obtaining either their Associate Systems Engineering Professional ASEP certification, or their Certified Systems Engineering Professional CSEP certification.

WPI is one of only six universities in the world to have such a memorandum of agreement with INCOSE. WPI's assistance will consist of helping students with the application process, reviewing their documents, and most important, providing a review course or "boot camp" on systems engineering that students can take before they sit for the INCOSE exam, which is required as part of the certification process.

More information

Some Systems Engineering-Relevant Websites

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http://www.site.uottawa.ca/~shervin/courses/elg5100/project/list.html

This web page contains a number of interesting downloads of presentations, mainly software related, for example:

- Agile Requirements: Can We Have Our Cake and Eat It Too
- Time Separation, Coordination, and Performance in Technical Teams
- Lying On Software projects.

http://www.systemswiki.org/index.php?title=Main_Page

This is a website of Systems Thinking World, a nonprofit organization which operates with contributions from individuals, organizations and friends supporting its endeavor to Enable a Systems Thinking World. The Wiki provides many useful resources, including:

- free webinars,
- Insight Maker, a free web based multi-user modeling & simulation environment supporting collaborative model development,
- learning resources,
- Systems Thinking World Journal, and
- Model Library.

http://www.ideasgroup.org/

This is the website of IDEAS, the International Defence Enterprise Architecture Specification for exchange. The purpose of the project is to develop a data exchange format for military Enterprise Architectures. The purpose is to allow seamless sharing of architectures between the partner nations (Australia, Canada, UK and USA) regardless of which modeling tool or repository each uses. The initial scope for exchange is the architectural data required to support coalition operations planning:

- Systems – communications systems, networks, software applications, etc.
- Communications links between systems.
- Information specifications – the types of information (and their security classifications) that the communications architecture will handle.
- Platforms & facilities.
- System & operational functions (activities).
- People & organizations.
- Architecture meta-data – who owns it, who was the architect, name, version, description, etc.

The site contains a great deal of conceptual data on enterprise architectures, and also explains IDEAS use of the Boro Methodology, which avoids the endless debating of the meanings of terms, a common problem in collaborative modeling activities.

http://www.boroprogram.org/boro_centre/index.htm

This is the site of the BORO Centre. The BORO Centre is a private corporation that has been set up to assist enterprises in exploiting Reference Ontologies (RO) based upon the Business Object (BO) paradigm. The BORO Methodology is a systematic process for the re-engineering of a business model from existing enterprise materials. Its key feature is the ability to extract the underlying general patterns that inform the enterprise - enabling much simpler business systems to be constructed. The approach uses very rigid criteria for identifying common concepts. Its main advantage is that it does not rely on names for things, so the methodology is very effective in achieving consensus in team modeling sessions. The BORO Method results in anontology (a description - like a formal specification - of the concepts and relationships that can exist for an agent or a community of agents. This definition is consistent with the narrower usage of ontology as set-of-concept-definitions).

http://www.layrib.com/Teaching/Teaching_Intro_EA/Intro_EA.html

This webpage of Dr. Edward Lewis, and linked pages, provide a great deal of information on designing viable and effective work systems. The site includes an interesting overview of architectural frameworks, including some less-than-complimentary remarks about the defense (defence) architectural frameworks.

http://www.incose.org/practice/webinars.aspx

This webpage, accessible to INCOSE members, provides access to over forty one-hour webinars on aspects of systems engineering, as follows:

- 19 September 2012, Webinar 15:00 UTC: "Agile Systems and Processes - Necessary and Sufficient Fundamental Architecture" - Rick Dove
- 15 August 2012, Webinar 15:00 UTC: "The Organization Mind-Set: Learning to Think and Act in Terms of Systems" – Professor Harold “Bud” Lawson
- 25 July 2012, Webinar 15:00 UTC: "Nine Laws of Effective Systems Engineering" – Zane Scott
- 20 June 2012, Webinar 15:00 UTC: "IceCube as an Engineering Case Study" – Randall C. Iliff
- 18 April 2012, Webinar 15:00 UTC: "An Overview of INCOSE Professional Certification" – David D. Walden
- 15 February 2012, Webinar 15:00 UTC: "Affordable Architectures - How do I recognize one?"
- 18 January 2012, Webinar 15:00 UTC: "Foundations of Relational Complexity Theory" – Dr. John J. Kineman
- 21 December 2011, Webinar 15:00 UTC: "Training Systems Engineers in Project Management A Simulation Based Training (SBT) approach"- Professor Avraham Shtub
- 16 November 2011, Webinar 15:00 UTC: "The Body of Knowledge and Curriculum to Advance Systems Engineering" – Dr. Art Pyster
- 19 October 2011, Webinar 21:00 UTC: "Nominations and Elections - INCOSE President-Elect Candidates Present Their Position Statements"
- 28 September 2011, Webinar 15:00 UTC: "Establishment of INCOSE Sectors and Sector Directors"
- 24 August 2011, Webinar 15:00 UTC: "The Systems Science WG Unified Ontology Project" - Jack Ring
- 20 July 2011, Webinar 15:00 UTC: "Opportunities and Challenges of Integrating Systems Thinking into Systems Engineering" - William D Miller
- 15 June 2011, Webinar 15:00 UTC: "Systems Engineering Measurement: A Journey of Insight" - Garry Roedler and Cheryl Jones
- 18 May 2011, Webinar 15:00 UTC: "Leveraging Systems Engineering to Improve Program Performance" - Joe Elm

- 20 April 2011, Webinar 15:00 UTC: "INCOSE Model Based Systems Engineering (MBSE) Initiative"
- 16 March 2011, Webinar 15:00 UTC: Powerful New Ways to Apply the n-Squared Diagram on Commercial SE Projects
- 16 February 2011, Webinar 15:00 UTC: Relevance of Natural Systems Science to Systems Engineering: Brief Intro to A System of Systems Processes (SoSP) Theory
- 19 January 2011, Webinar 15:00 UTC: Systems Engineering Return on Investment (ROI)
- 17 November 2010, Webinar 15:00 UTC: The BKCASE Project
- 20 October 2010, Webinar 15:00 UTC: Building Your Concept of Operations (CONOPS)
- 15 September 2010, Webinar 15:00 UTC: Strategies for Achieving Systems Engineering Success in Manufacturing-Dominated Cultures
- 18 August 2010, Webinar 15:00 UTC: AP233 Systems Engineering Overview
- 21 July 2010, Webinar 15:00 UTC: ISO/IEC 15288 and 12207 Modeling to Assess Harmonization
- 29 June 2010, Webinar 15:00 UTC: Complex Systems Engineering Working Group Webinar: Relevance of Natural Systems Science to Systems Engineering
- 19 May 2010, Webinar 15:00 UTC: An Update on INCOSE Professional Certification and the New Expert
- 21 April 2010, Webinar 15:00 UTC: Leading Indicators for Systems Engineering Effectiveness
- 17 March 2010, Webinar 15:00 UTC: Lean Enablers for Systems Engineering
- 17 February 2010, Webinar 15:00 UTC: Introducing Systems Engineering Principles to the Commercial Product Development Cycle
- 20 January 2010, Webinar 15:00 UTC: The Importance of Early Systems Engineering Activities and Associated Technical Products in Support of US Department of Defense Weapon Systems Development
- 16 December 2009, Webinar 15:00 UTC: Architecting Resilient Systems
- 18 November 2009, Webinar 15:00 UTC: K-12 Science, Technology, Engineering, and Mathematics Education
- 21 October 2009, Webinar 15:00 UTC: INCOSE President-Elect Candidates Present Their Position Statements
- 16 September 2009, Webinar 15:00 UTC: Divergent Thinking in Systems Engineering Practice: Is There a Shortfall?
- 19 August 2009, Webinar 15:00 UTC: Delivering NextGen - A System Engineering Perspective
- 15 July 2009, Webinar 15:00 UTC: Terminal 5 Rail Project: An Untold Success Story
- 17 June 2009, Webinar 15:00 UTC: AP233 and SysML Standards: An Introduction and Overview
- 20 May 2009, Webinar 15:00 UTC: How CAB Companies Can Make Best Use of the INCOSE Website
- 15 April 2009, Webinar 15:00 UTC: Preparing Technical Papers for Review; Reviewing Technical Papers
- 18 March 2009, Webinar 15:00 UTC: REGAL - Requirements Engineering Guide for All
- 18 February 2009, Webinar 16:00 UTC: What is ISO/IEC 15288 and Why Should I Care
- 21 January 2009, Webinar 16:00 UTC: The Application of the Eclipse Process Framework to Systems Engineering

http://www.iso-architecture.org/

This URL serves the websites of ISO/IEC/IEEE 42010: Systems and Software engineering — Architecture description and other activities related to architecture. Sections of the site are for:

- ISO/IEC/IEEE 42010 (the latest edition of IEEE Std 1471:2000);
- Architecture Evaluation;

- Architecture Viewpoint Library; and
- IEEE Std 1016:2009 Standard on Software Design Descriptions.

http://www.omgwiki.org/OMGSysML/doku.php?id=sysml-modelica:sysml_and_modelica_integration

This is the home page of a working group to explore the synergies between the OMG systems modeling language SysML and Modelica (www.modelica.org). Modelica® is a non-proprietary, object-oriented, equation based language to conveniently model complex physical systems containing, e.g., mechanical, electrical, electronic, hydraulic, thermal, control, electric power or process-oriented subcomponents. This Wiki-page is used to communicate among the working group members. The page contains or links to a wide range of information on the subject.

http://docs.behat.org/guides/1.gherkin.html

This page describes Gherkin, a Business Readable, Domain Specific Language created for behavior descriptions. It gives you the ability to remove logic details from behavior tests. Gherkin is a line-oriented language that uses indentation to define structure.

http://www.afit.edu/cse/index.cfm

This is the site of the United States Air Force Center for Systems Engineering, Air Force Institute of Technology. The site contains some excellent case studies, as well as:

- DoD Policies and Guidance,
- Air Force Policy and Guidance,
- Industry Standards and Guidance,
- Military Standards and Specifications,
- Other Government Policies and Guidance,
- Historical Policies and Guidance, and SE tools.

http://spacese.spacegrant.org/

This Space Systems Engineering website is sponsored by NASA's Exploration Systems Mission Directorate and the Texas Space Grant Consortium. The materials accessible from this website include:

- 27 systems engineering lecture modules
- Accompanying example assignments and exams
- Reference documents and handbooks from NASA and other government sources Additional recommended readings related to systems engineering
- 2 video lectures on being a systems engineer by Gentry Lee of JPL
- Links to companion websites of interest to the space systems engineer
- Presentations from NASA's Systems Engineering Workshop, which took place in October, 2008.

Interestingly, the only industry source cited under “Resources” is PPI’s Systems Engineering Newsletter (SyEN). The site says in response to the question “What are the systems engineering course materials based on”, that “The SE Course content is based on numerous systems engineering handbooks and primers from NASA and the Department of Defense organizations. The content also reflects material from professional training courses offered at NASA and through organizations such as Project Performance International”. Thanks for the credit, guys!

http://www.mors.org/about/default.aspx

This is the site of MORS, a USA-based Military Operations Research Society.

http://blogs.crescendo-technologies.com/deploiement-ingenierie-systeme-intro/?goback=.gde_67221_member_122024118

This is a new blog, in French, on system engineering deployment techniques.

http://www.behaviorengineering.org/index.php

This site is dedicated to behavior engineering. Behavior engineering is an integrated discipline that supports the systems and software engineering of large-scale, dependable software-intensive systems. Behavior engineering employs a graphical Behavior Modeling Language (BML) that is used to construct complete behavioral, compositional and structural integrated views from natural language descriptions of a large set of requirements for a proposed system. Together these three formalized views extract all the useful information that is needed to preserve and clarify the intension expressed in natural language requirements. A Behavior Modeling Process (BMP) used to construct the integrated views.

http://www.stups.uni-duesseldorf.de/w/User:Jastram

This webpage of Michael Jastram contains a number of papers on aspects of requirements engineering.

Standards and Guides

IEEE Standard for System and Software Verification and Validation

IEEE Std 1012-2012, IEEE Standard for System and Software Verification and Validation was published on 25 May 2012. Verification and validation (V&V) processes are used to determine whether the development products of a given activity conform to the requirements of that activity and whether the product satisfies its intended use and user needs. V&V life cycle process requirements are specified for different integrity levels. The scope of V&V processes encompasses systems, software, and hardware, and it includes their interfaces. This standard applies to systems, software, and hardware being developed, maintained, or reused [legacy, commercial off-the-shelf (COTS), non-developmental items]. The term software also includes firmware and microcode, and each of the terms system, software, and hardware includes documentation. V&V processes include the analysis, evaluation, review, inspection, assessment, and testing of products.

More information

Definitions to Close on

Product and Service

Product: something produced by human or mechanical effort or by a natural process.
Source: The Free Dictionary by Farlex

Product: something produced by effort, or some mechanical or industrial process.
Source: Collins English Dictionary

Product: a good, idea, method, information, object, or service that is the end result of a process and serves as a need or want satisfier.
Source: http://www.businessdictionary.com

Product: something produced.
Source: http://www.merriam-webster.com

Service: an act or a variety of work done for others.
Source: The Free Dictionary by Farlex

Service: an act of help or assistance.

Source: Collins English Dictionary

Service: a valuable action, deed, or effort performed to satisfy a need or to fulfill a demand.
Source: http://www.businessdictionary.com

Service: the work performed by one that serves.
Source: http://www.merriam-webster.com

Service: work performed that changes some aspect of the state of the universe to the benefit of another person or enterprise.
Source: Robert Halligan

PPI News (see www.ppi-int.com)

Dr. Ralph Young Has Retired as Editor of SyEN

We are sad to advise that Edition 47 was Dr. Ralph Young's last edition as Editor of SyEN. Ralph has made an outstanding contribution during his period as Editor. I would like to publicly thank Dr. Young for his outstanding efforts contributing to the systems engineering community by way of SyEN, and to wish him every success and joy of life in the future.

Robert Halligan FIE Aust
Managing Director, Project Performance International

Welcome Suja Joseph-Malherbe

I am delighted to welcome and introduce Mrs. Suja Joseph-Malherbe as the third Editor of SyEN, following in the footsteps of Dr. Ralph R. Young and Mr. Alwyn Smit. In a way, this passing of the baton is mirroring what is happening to a great degree in Suja's home country of South Africa, where a cadre of older, very experienced systems engineers, diminishing rapidly through retirement, is passing the baton on, not to a largely non-existent next generation of engineers, but to the next generation again of younger, recently graduated engineers. Engineers who have grown up with systems engineering in their education to varying degrees, and who are excited by what it has to offer, both personally and to society.

Suja is an engineer with South Africa's Council for Scientific and Industrial Research (CSIR), since 2003. She was part of a modeling and simulation project team that developed various solutions for decision support to the South African Air Force before moving to the application area of power systems. Suja currently practices as a systems engineer for projects developing power sources and power management systems for the dismounted soldier. She has a keen interest in complexity theory, systems engineering and strategic thinking and planning. Suja also serves on INCOSE South Africa's Chapter Management Committee as Membership Officer. She holds an M. Eng. in electrical and electronic engineering from the University of Johannesburg and a B. Sc. in electrical engineering from the University of the Witwatersrand.

You are reading Suja's first SyEN. Enjoy! Welcome Suja, you bring a passion and youth to the task that bode well for another exciting chapter in the history of SyEN.

Robert Halligan, FIE Aust
Managing Director, Project Performance International

Welcome to the PPI Family - Mr Les Chambers BE (Hons)

PPI has recently signed a milestone agreement with Mr Les Chambers to deliver training in Software Engineering to PPI clients across six continents.

Les is a professional software and systems engineer with more than 35 years experience. He has assumed full responsibility for the development and operation of many safety-critical systems. In the context of projects in the USA, Asia, the Middle East and Australia, Les has performed the sum of all tasks required to construct a software and electronic system, from project manager, safety authority, quality manager, configuration manager to requirements engineer, V&V engineer, design authority, system architect, controls engineer, software developer and hardware designer. He holds an Electrical Engineering Honours degree from the University of Queensland (Australia).

More recently, Les has gone on to deliver public and on-site training courses in quality management, project management, requirements specification and functional safety management. As a trainer, Les' international experience in the nuts and bolts of developing reliable software-intensive systems provides a wealth of case studies. His courses are consistently rated highly for his mastery of the subject and his ability to entertain and motivate the participant. Les is also a prolific writer in the disciplines of software and systems engineering and his website http://www.systemsengineeringblog.com is testament to this claim.

PPI's Software Development Principles and Practice - How to develop the right software right (SDPP) Training - Renamed, Revised, and Sexier than ever

PPI has re-launched its popular Software Development Principles and Practices workshop under the TLC of guru Mr Les Chambers. The workshop has been renamed to better capture the essence of this training. Our workshop, already generating considerable interest, is a 5-day immersion in the development of software systems, with a focus on leading software engineering development and management principles, processes and practices. We are offering public and on-site deliveries throughout the world for the remainder of 2012 and 2013, including locations such as Sydney, Melbourne, Amsterdam, Las Vegas and Pretoria.

The workshop, squarely focused on software development, brings the important systems perspective into the discipline (i.e. an interdisciplinary, collaborative approach to the engineering of software solutions which aims to capture stakeholder needs and objectives and to transform these into a holistic, lifecycle balanced system solution which both satisfies the minimum requirements of the stakeholders, and optimizes overall software solution effectiveness according to the values of the stakeholders).

Upon completing this workshop, you will be able to:

- become an advocate in your organization for practical methods to improve software project performance.
- identify software development problems and drive project performance improvements.
- value the substantial body of public domain knowledge that defines world's leading practice in software engineering. For example, ISO/IEC/IEEE 12207, other IEEE and ISO standards, the Software Engineering Institute (SEI) Capability Maturity Models and the Guide to the Software Engineering Body of Knowledge (SWEBOK).

For more comprehensive information, please visit the Software Development workshop webpage (http://www.ppi-int.com/training/software-development-course.php)

PPI's Systems Engineering Key Downloads

As a benefit to our clients and friends, we have relaxed copyright restrictions on our incredibly popular DIDs available at the Systems Engineering Key Downloads page of our website. The new conditions provide you with greater flexibility to use these resources in your day-to-day engineering.

More information

CTI takes INCOSE CSEP Exam Preparation Training to Europe

Certification Training International (subsidiary company of PPI) has completed its first CSEP Exam Preparation training course public delivery in Europe, in the wonderful Dutch city of Amsterdam. This well supported course already had delegates from across Europe including Sweden, United Kingdom, the Netherlands and Turkey. For additional information about this workshop, please visit http://www.certificationtraining-int.com

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PPI Events (see www.ppi-int.com)

Systems Engineering Public 5-Day Courses

Upcoming Locations Include:

- Amsterdam, The Netherlands
- Adelaide, Australia
- Brisbane, Australia
- Rio de Janeiro, Brazil
- Munich, Germany

Requirements Analysis and Specification Writing Public Courses

Upcoming Locations Include:

- Melbourne, Australia
- Stellenbosch, South Africa
- Las Vegas, USA
- Amsterdam, The Netherlands

Software Engineering Public 5-Day Courses

Upcoming Locations Include:

- Sydney, Australia
- Pretoria, South Africa
- Amsterdam, The Netherlands

OCD/CONOPS Public Courses

Upcoming Locations Include:

- Brasilia, Brazil
- Pretoria, South Africa
- Las Vegas, USA

Cognitive Systems Engineering Courses

Upcoming Locations Include:

- Adelaide, Australia
- Las Vegas, USA

CSEP Preparation Course (Presented by PPI subsidiary Certification Training International)

Upcoming Locations Include:

- Las Vegas, USA
- Austin, USA
- Munich, Germany

PPI Upcoming Participation in Professional Conferences

PPI will be participating in the following upcoming events. We look forward to chatting with you there.

- New Zealand Defence Industry Association Forum 2012 | Exhibiting | Wellington, New Zealand (16 - 17 October, 2012)
- Land Warfare Conference 2012 | Exhibiting | Melbourne, Australia (22 - 26 October, 2012)
- MilCIS 2012 Conference | Participating | Canberra, Australia (6 - 8 November, 2012)
- CSD&M 2012 Conference | Participating | Paris, France (12 - 14 December, 2012)

Kind regards from the SyEN team:
Robert Halligan, Managing Editor, email: rhalligan@ppi-int.com
Suja Joseph-Malherbe, Editor, email: sjosephmalherbe@ppi-int.com
Stephanie Halligan, Production, email: shalligan@ppi-int.com

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Tell us what you think of SyEN: email to contact@ppi-int.com

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