# Project Performance International

**Systems Engineering**

**Newsletter (SyEN)**

**SyEN #029 - February 21, 2011**

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**Dear Colleague,**

SyEN is an independent free newsletter containing informative reading for the technical project professional, with scores of news and other items summarizing developments in the field, including related industry, month by month. This newsletter and a newsletter archive are also available at www.ppi-int.com.

**Systems engineering can be thought of as the problem-independent, and solution/technology-independent, principles and methods related to the successful engineering of systems, to meet stakeholder requirements and maximize value delivered to stakeholders in accordance with their values.**

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## What's Inside:

### Systems Engineering Software Tools News

- isee systems Live Web Seminar - Exploring Options for Creating Online Simulations
- Atego 1 Day Tutorial - Introduction to Model-Based Requirements Engineering
- Ravenflow Launches Business Analyst Building Blocks Program
- Launch of Artisan Studio ParaSolver speeds the exploration of complex SysML systems design alternatives
- Rommana Integrated Lifecycle Manager New Release

... READ MORE

### Systems Engineering Books, Reports, Articles and Papers

- Requirements Engineering for Software and Systems
- Control Systems Engineering
- Customer Service Incorporates Systems Thinking in 2010
- Modeling Dynamic Systems - Third Edition
- Requirements Engineering: Fundamentals, Principles, and Techniques
- Engineering Mega-Systems: The Challenge of Systems Engineering in the Information Age
- 10 Useful Ideas on Systems Thinking
- Panarchitecture: Architecting a Network of Resilient Renewal
- Systems of Systems: Managing Complexity

... READ MORE

### Conferences and Meetings

... READ MORE

### Education and Academia

- Systems Modeling Language (SysML) Training - A Quick Start to Model-Based Engineering and Model-Based Systems Engineering (MBE/MBSE)
- DoD Systems Engineering Research Center (SERC)
- Summer Courses at Harvard - Systems Thinking
- ISU/Stevens Graduate Certificate in Space Systems Engineering
- Immediate Postdoctoral Opening in Systems Requirements Engineering at Masdar Institute
- Assistant Professor of Systems Engineering (2 Positions)
- Newcastle University: Lectureship in Dependable Architectures
- A research position (Post-doc) is available at the INRIA Rennes Bretagne Atlantique Research Center in the team-project Triskell, Rennes, France

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### Some Systems Engineering-Relevant Websites

... READ MORE

### Standards and Guides

- ISO/IEC JTC 1/SC 35 - User interfaces
- IEEE Standards Association (IEEE-SA)
- Should SC7 Develop Competency Standards

... READ MORE

### Some Definitions to Close On

- Integration
- System Integration
- System Integrator

... READ MORE

### PPI News

- CTI Delivers CSEP Preparation 4-Day Course to INCOSE South Africa Members

... READ MORE

### PPI Events

... READ MORE

# A Quotation to Open On

*"Chaos in the world brings uneasiness, but it also allows the opportunity for creativity and growth."* - Tom Barrett

# Featured Article

## CHAOS AND WHY A SYSTEM ENGINEER SHOULD KNOW ABOUT IT

Dr Jan Roodt – StoneToStars Limited, New Zealand
Jan.roodt.nz@gmail.com

### 1. Introduction

A few articles are planned for this year that will focus on non-linear dynamic systems. Some will focus on complexity and emergence, and I hope that this one will be a readable introduction to the field of Chaos Theory. Expect no more than Chaos 'lite' in this first instalment, though. For some this will be old news, and for some I hope that it will bring a greater sensitivity for how our best laid plans and designs may go spectacularly wrong on occasion.

### 2. The Concept of Chaos

The word 'chaos' means different things to different people. My secretary thinks of my office as a place of chaos, a place where it is impossible to find things, a place devoid of order. She sees a randomness in the piles of paper stacked all over the place. There is no obvious principle for the 'organisation' of the papers into piles. This is not the type of chaos I want to discuss in this piece.

The concept of chaos that we are interested in system engineering has to do with the temporal behaviour of a system. A system consists of parts that interact. As we know, modern systems have many interdependent parts, including human beings and even the environment. This makes it conceptually and practically difficult to pin down the behaviuor under all operational conditions. We recognize today that there are more nonlinear parts in any interesting system than there are linear elements. It is precisely these nonlinear elements that may cause unexpected behaviour, no matter how well we characterized the system initially. A sudden change in a nonlinear system may give rise to 'chaos'. According to Hilborn [1], chaos is only one type of behaviour exhibited by nonlinear systems.

The interesting thing about chaotic behaviour is that we can demonstrate it using very simple equations. The only rider is that these equations must be non-linear. Consider the following simple equation, taken from an example in [2]:

$$x_{t+1} \leftarrow 1.9 - x_t^2$$

This is an iterative (or difference) equation, meaning that for any time-step in the future, we use the previous value of the equation, generated at the previous time-step as the value of the time dependent variable to generate the next value. The equation is nonlinear because it is quadratic in the time dependent term $x_t^2$ . Plotting the values on the left hand side against discrete time steps delivers the graph in Figure 1.

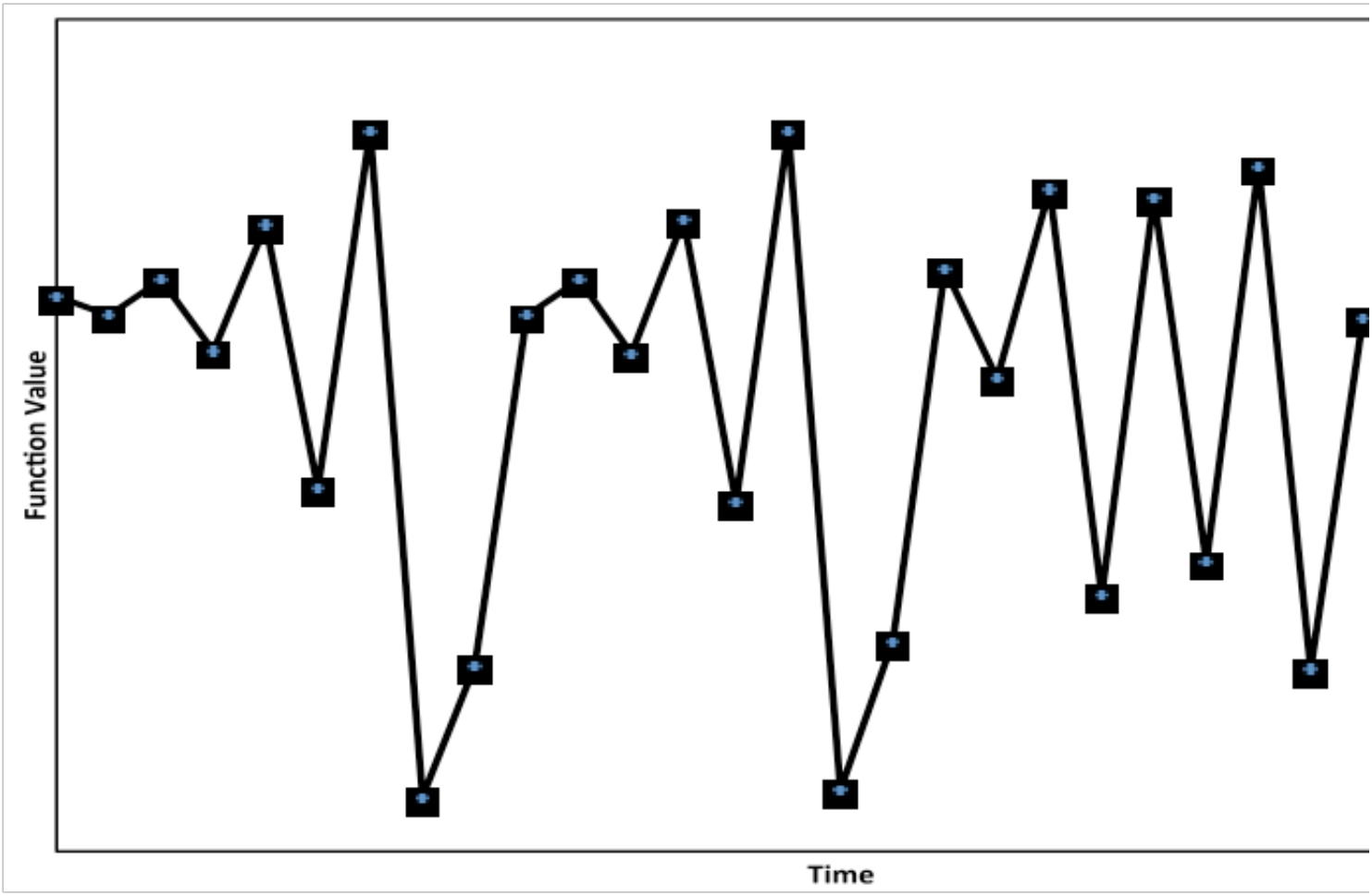



**Figure 1. This could well be the price of gold over time.**

There are a few interesting things we notice. First of all, the graph is erratic, and there is no obvious pattern or cycle. The graph was generated by a deterministic equation, not by some random (stochastic) process. The equation, in one variable, is rather simple – a simple quadratic difference equation. And finally, I calculated this graph in Microsoft Excel, and there was no sampling noise or other noise sources that could influence the shape. The system we described with our equation has very erratic behaviour and it is fully deterministic. Every subsequent value of $x_{t+1}$ is calculated only by using the previous value of $x_t$.

And it is here that we discover another interesting fact about this system. If I use a specific precision to generate the graph, I get a specific shape. If I use a lower precision, the graph starts off the same, and then it starts to deviate after a while, in a very unpredictable manner. It is not just that the difference grows. No, in some areas the graph actually reverts to values very close to that of the high precision version (Figure 2).

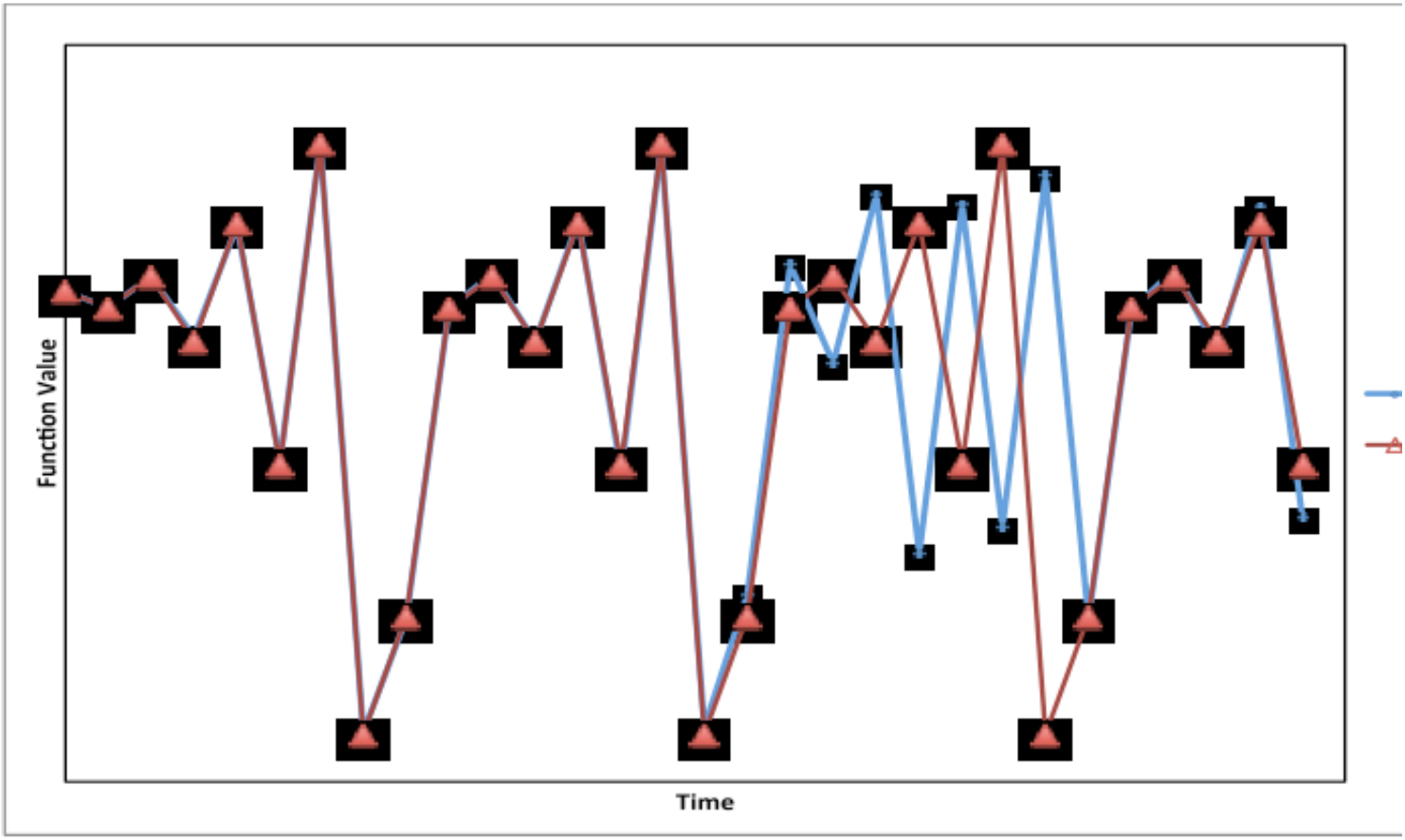



**Figure 2. The same equation using different calculation precision.**

This has grave consequences for us in modelling of a system, and I will come back to this later.

Another interesting property of this type of system was discovered by Edward Lorentz during his work on weather phenomena and weather prediction. Lorentz ran his models on the computers of the time (1963) and sometimes he would stop a model, write down the current values of the system and then restart the model later from that point, using the recorded values. He found even his simplest models for the weather very sensitive to the starting values or the restart values. Remember, in a difference equation, the next function value is only a function of the current value. Melanie Mitchell says that even today our best weather models are only good for about a week into the future, and that it is uncertain if this is as a result of the inherent chaotic nature of the weather systems or if it is just that we lack enough data [3]. My guess is that it is the former.

Let us have a look at what happens if I start our simple equation with a value $x_0$ = 1.001, rather than 1.000. As expected, the new graph is also erratic and moves away from the other two graphs rather early and by the tenth iteration, the difference is visible in Figure 3 below.

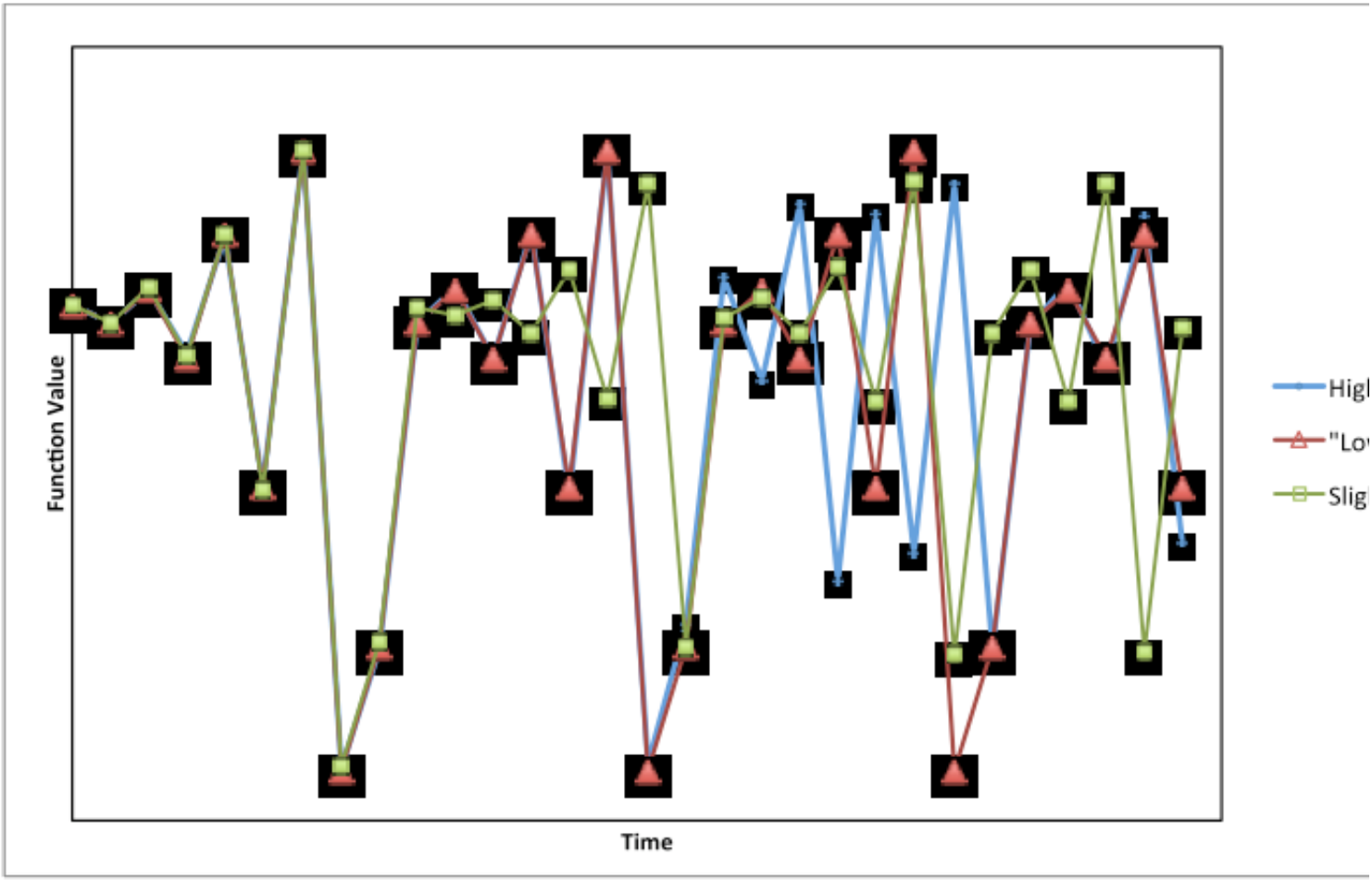



**Figure 3. A slightly different initial condition causes a different outcome.**

It should now be clear that we may demonstrate chaotic behaviour simply by iterating mathematical equations of the type I used here. But what causes chaos in nature? We are not all that sure. What we do know is that we can see chaotic behaviour in chemical reactions and replicate it in the laboratory, for example.

Nicolis and Prigogine [4] gives a very topical example of the variations n global ice forming, as inferred from isotope records of deep sea cores. Not surprisingly the graph of ice volume over the past million years looks similar to the graph of our simple system. Ice forming is probably a function of solar and planetary systems interacting. How all these elements come together is not known, making the current debate on global warming and climate change even more interesting. The short answer seems to be that we know that we do not know enough.

## 3. Analysing Chaos

As engineers we need to know about a phenomena and hence we have to find ways of working with it to ensure that our real world solutions to problems are safe and sound. If we develop plans for a sky scraper, it is important to understand the physical properties of the materials we will use, and it is critical to understand the systems in which our solution will be embedded, the conditions of the soil, rock structure and the atmosphere, to name a few.

Because we now know that chaos is not equivalent to randomness, analyzing our data can help us understand if there is an orderly or deterministic system driving it or not. If it is deterministic we may be able to discover the laws driving the data, and we may be able to model it for better understanding. As we have seen with the work of Lorentz, sometimes knowing that the state of a system cannot be reliably predicted too far into the future is useful so that we do not expend energy and resources trying to do so, or to design for something that cannot be reliably shown to be a future state of the system.

For this part of the discussion I shall use the standard example of population growth. Consider a population of fruit flies. These flies have a seasonal cycle and the population in one cycle depends on the population in the previous cycle that reached breading maturity. Several factors may inhibit or quicken the population growth. Assume we can throw all these into one “control” parameter *a*. A typical population prediction difference relationship may look like this:

$$x_{t+1} \leftarrow a x_t (1 - x_t)$$

It is obviously non-linear in the population parameter $x_t$ and is known as the logistic equation. Using the Mathematica™ package and some demonstration code [5], the behaviour of the system can be inspected. I use normalized values here to demonstrate the principles, which means that if I set $x_t$ = 0.4, then we will be using 40% of the maximum population in the fruit fly world. For an initial environmental control value of $a$ = 0.95, we can see that the population will become extinct after about 50 seasons - Figure 4.

Another way to look at this is to draw the associated phase diagram. In this map we see the parabolic shape of the quadratic population generation curve. On it we draw a line for $x_0$ = 0.4 vertical until it intersects with the parabola. This value is the value of the next population at $x_1$. We now draw a new line horizontally, to where it hits the line corresponding to $x_1 = x_{t+1}$, then a vertical line down to the parabola and then horizontally back to the straight line, which indicates the next value of the population. It can be seen how this zig-zag moves to the origin of the graph after a few iterations - Figure 5. In fact, any value of $x_0$ used with a control value of less than unity, will tend to zero. The series of population numbers is called the orbit or trajectory of the system and it is attracted to zero. From a practical perspective it means that as long as the factors contributing to $a$ result in $a$ < 1, the population will die out.

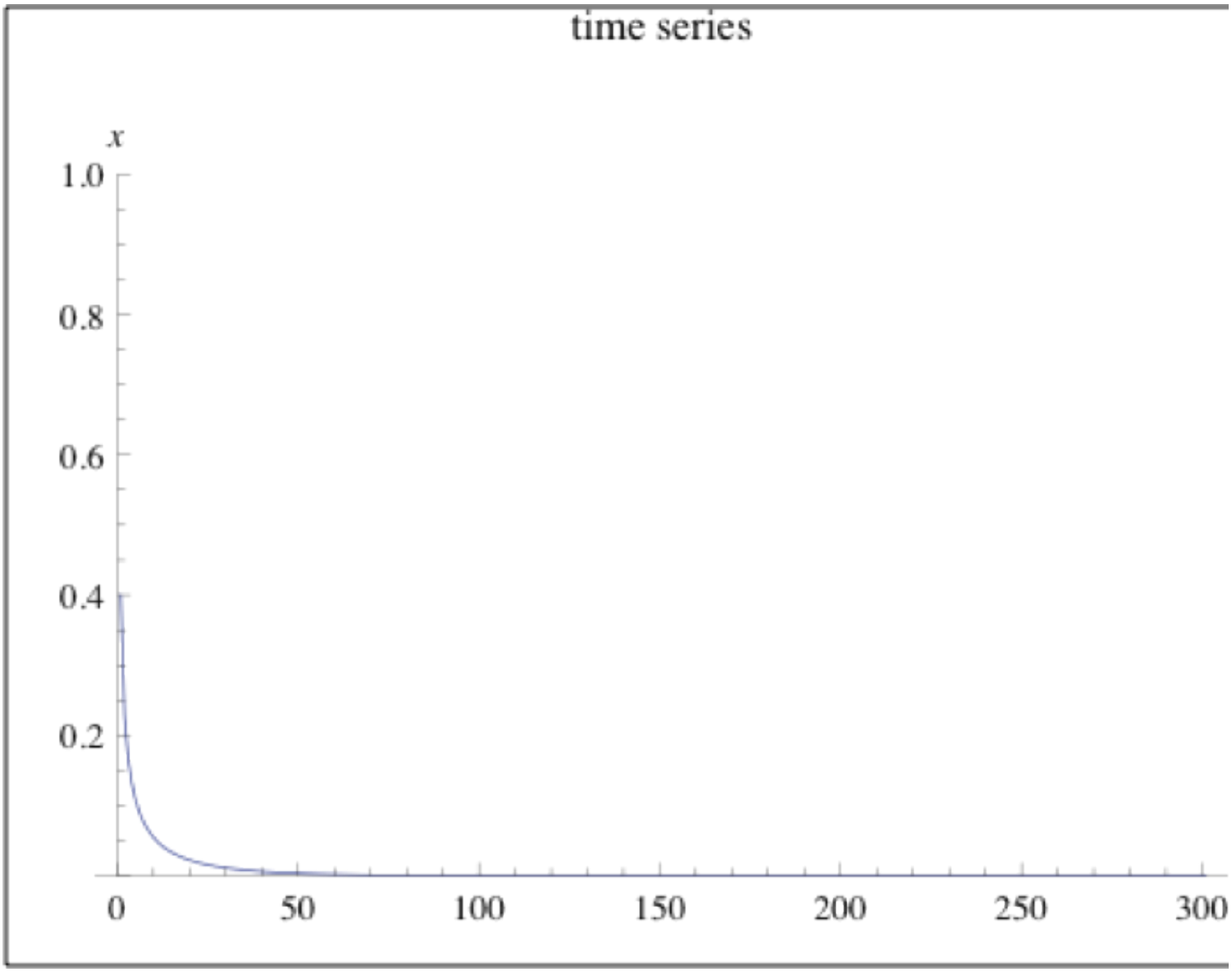



**Figure 4. The population converges to zero – or dies out.**

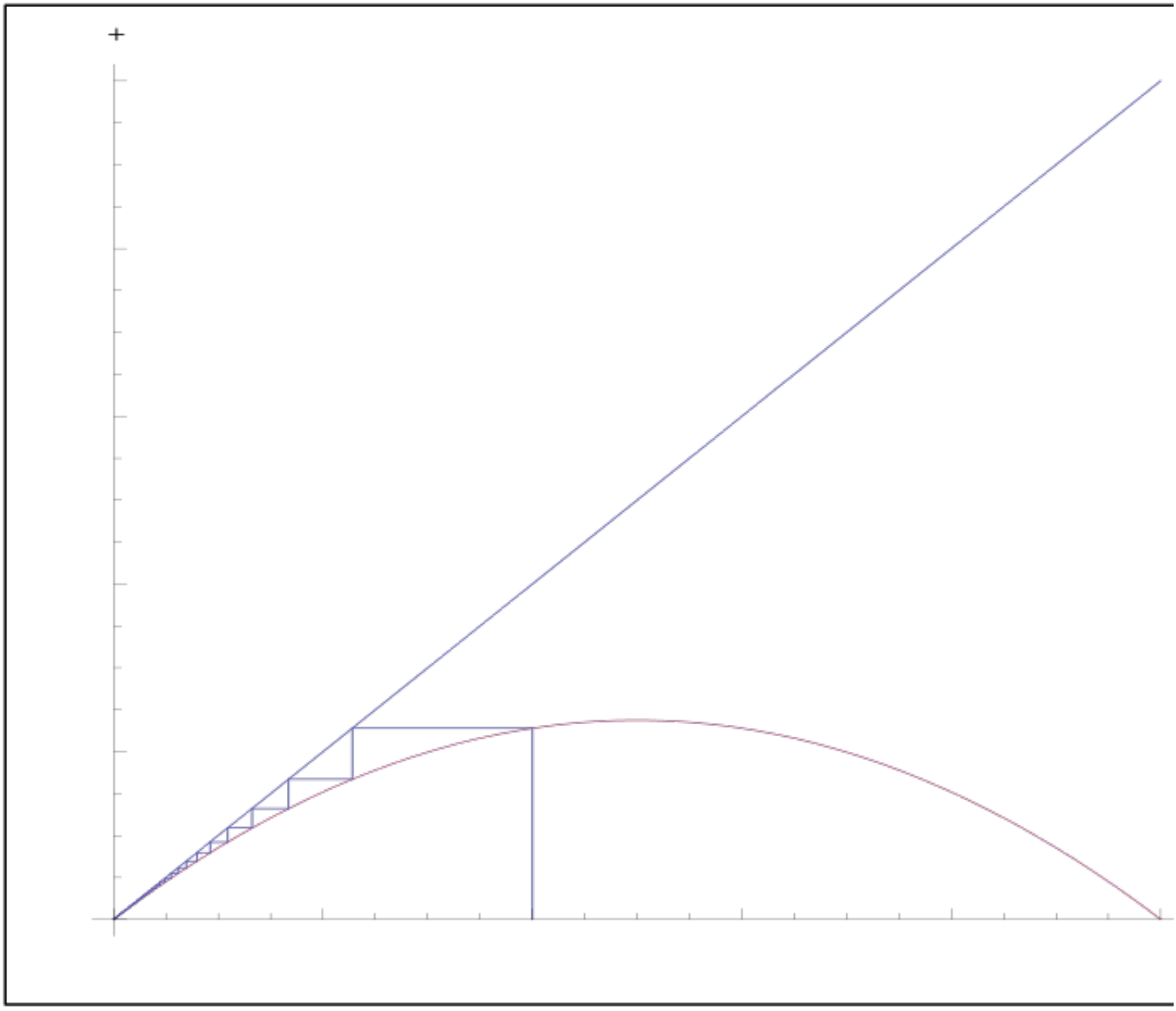


**Figure 5. The phase map of a population in decline.**

By choosing new values for *a* and *x*, a new attractor can be found (Figure 6).

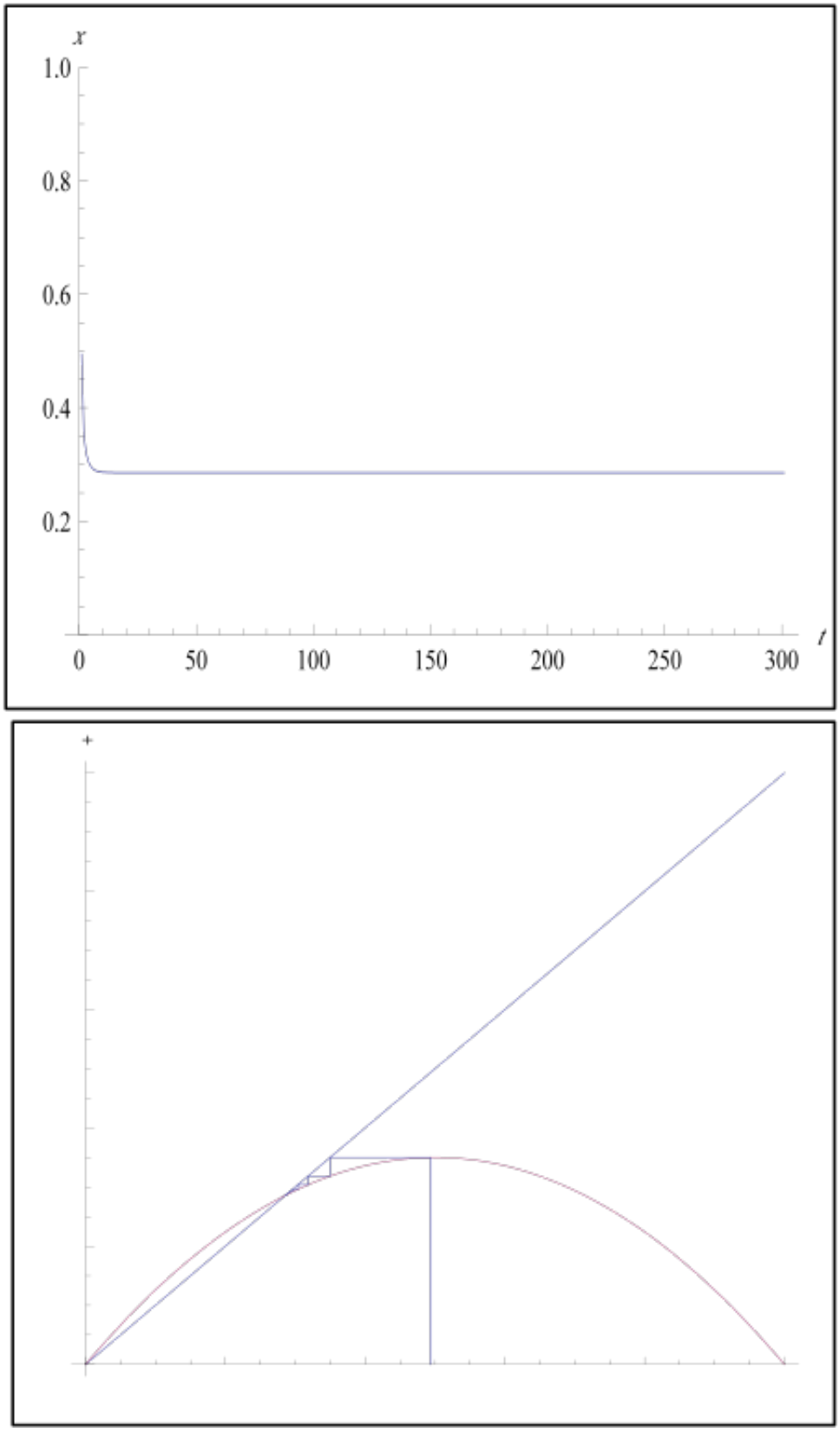



**Figure 6. The population stabilises at about 28%**

A more interesting result is achieved when we set $a$ = 3.5, $x_0$ = 0.5. Four attractor values appear: 0.87, 0.82, 0.46 and 0.38. This translates into a population of fruit flies at 87% one year, then at 46% another year, etc.

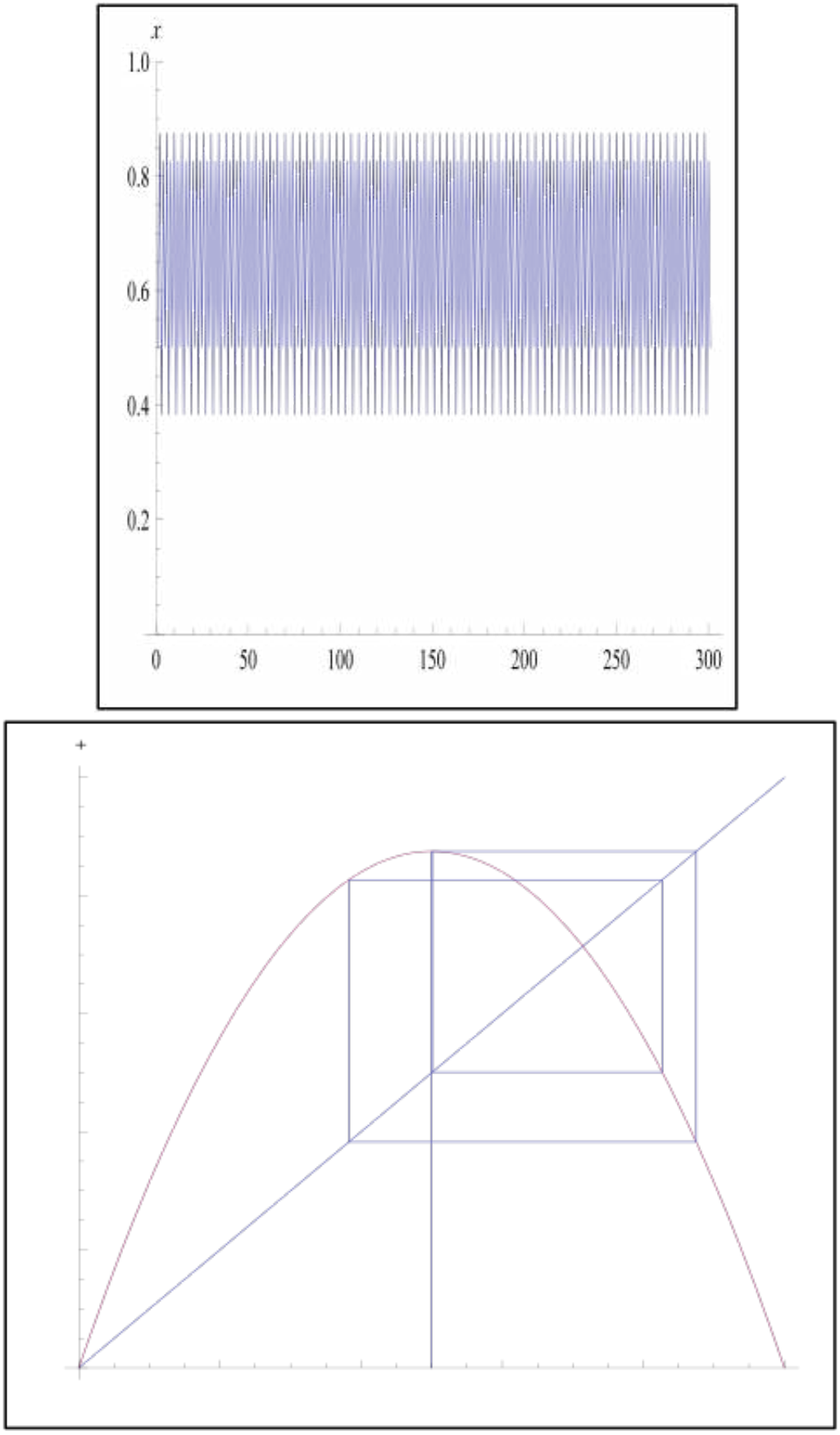
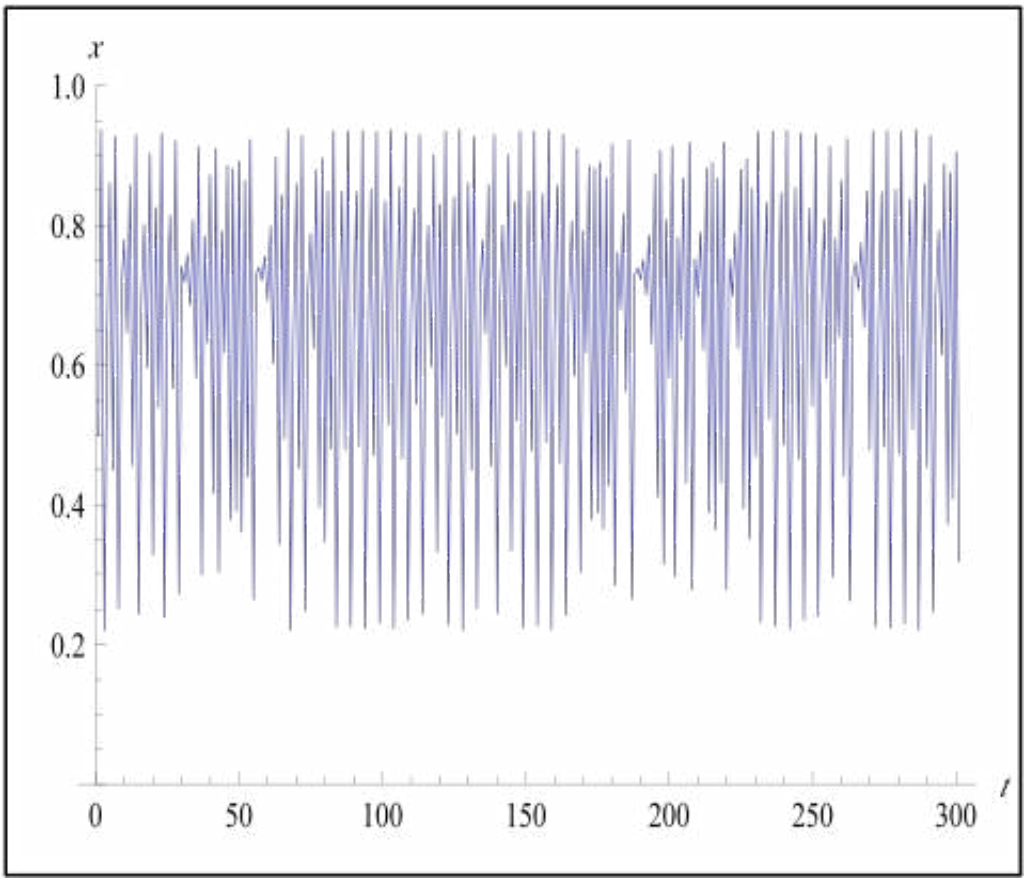



**Figure 7. Variable populations appear.**

Once *a* > 3.6 we have a situation where the population is chaotic, as shown in Figure 8. The typical haphazard temporal graph reflects in the chaotic phase diagram. It is very difficult to predict the fruit fly population with certainty several cycles into the future. Any uncertainty in the population will reflect in even bigger error a few cycles down the line, as the behaviour of the system is highly sensitive to the value of the events that drive the control parameter *a*.

It is realistic to use other approximations for the fruit fly populations in the cases where the control parameter was not driving the system into chaos. However, in the chaotic region, none of the other models would deliver realistic predictions of future populations.



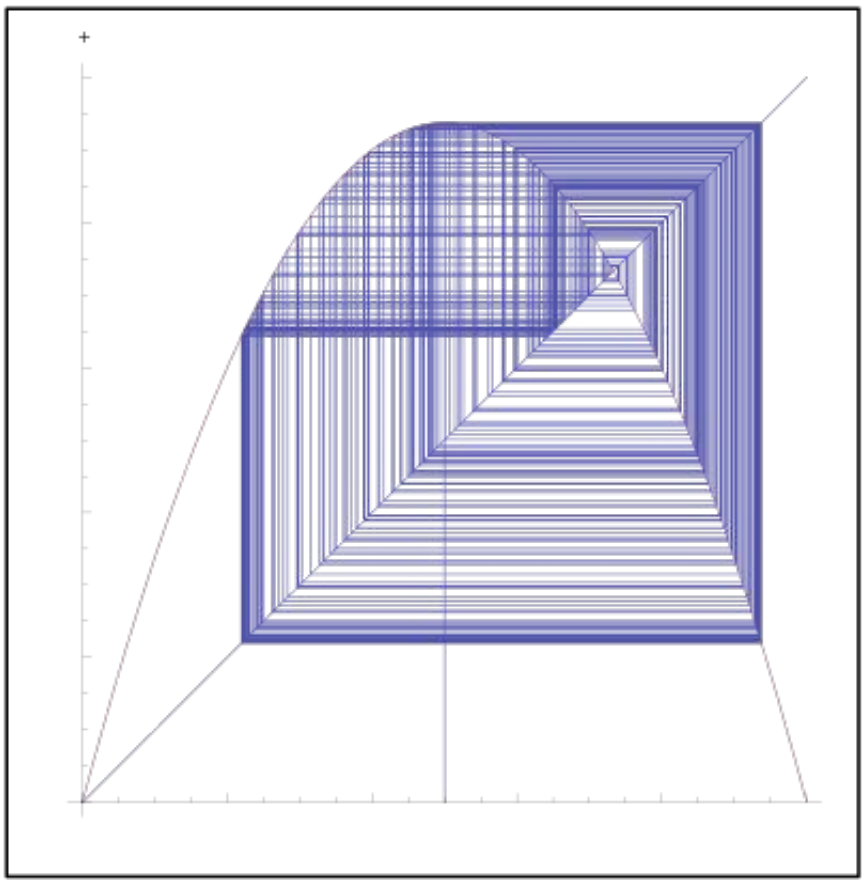



**Figure 8. The chaotic region.**

The time spectrum does look like noise, and without having prior knowledge, it would take someone with strong imagination to consider this a graph of the chaotic region of the fruit fly eco system. If we were to take a discrete Fourier transform of the data samples, it is possible to construct a power spectrum graph. If the system was truly random (white noise) the power spectrum should be uniform, as all frequencies are present in equal numbers. As a non-linear dynamic system moves into a chaotic region, the power spectrum will show the doubling of the attractors and it will eventually show a spectrum similar to the one below. This is not a sure-fire way to show that a system is chaotic and other techniques may be necessary in conjunction. In future papers we may look into this.

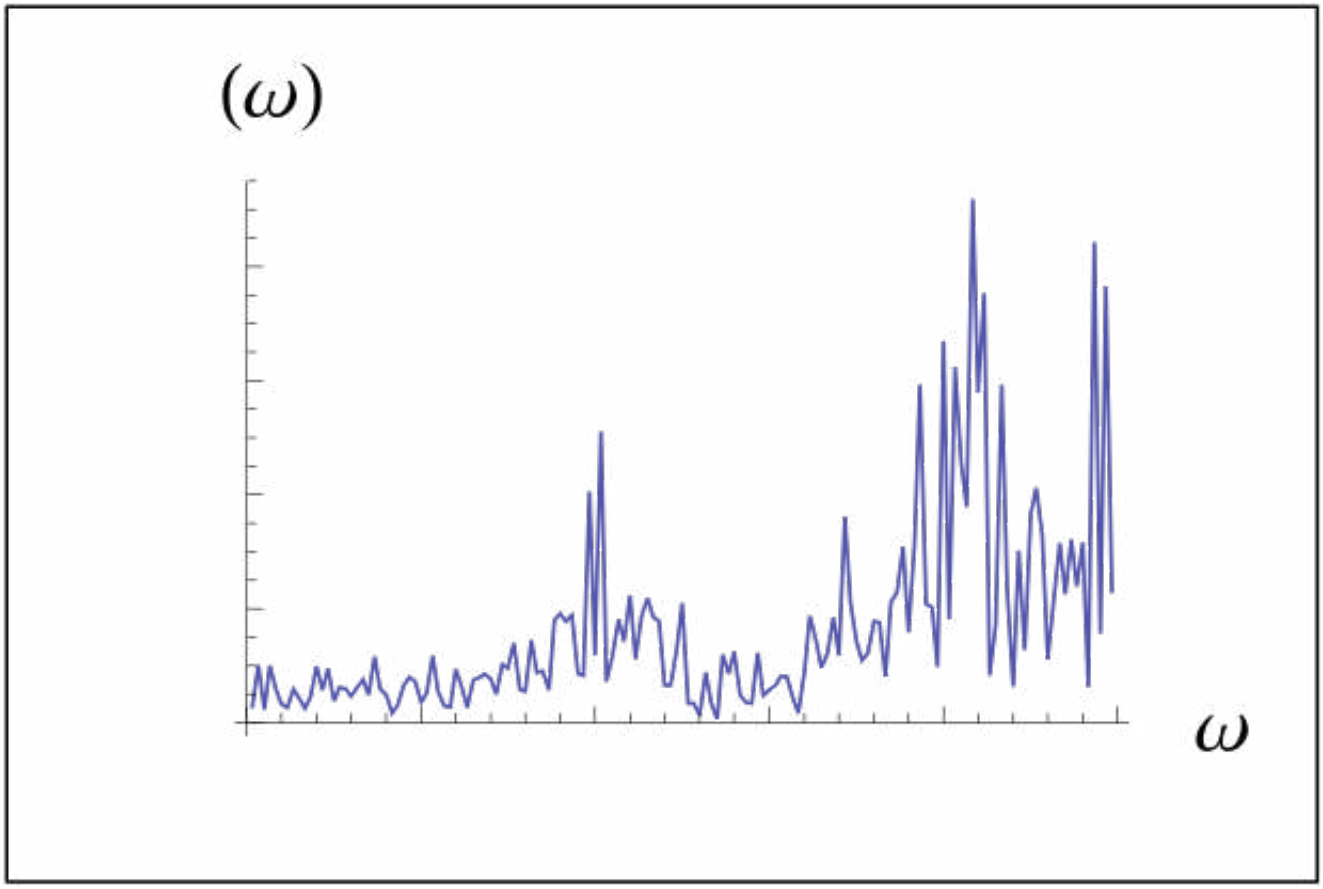



**Figure 9. Power spectrum of the chaotic region of the fruit fly system.**

## 4. Modelling Under Chaos Conditions

I mentioned earlier that chaos have some consequences in the field of modelling. Modelling is the art of discovering and identifying regularities in systems and using these to develop simplified artefacts (in software, hardware, etc.) using mathematical constructs that will emulate the observed properties to some degree of realism. In an earlier article in this newsletter [6], I stated that although it is not possible to develop absolute models of complex systems, it is still possible to develop a range of models that will allow the systems engineer to design and deliver real working systems. In the case of systems with chaotic behaviour it is important to realize this early on. Often the irregular temporal evolution of a system is attributed to noisy data, caused by systems outside the system boundaries.

The danger is that engineers will run to find the closest data fitting algorithm and fit the data to a simpler equation. One can see that looking for trends in chaotic data in the classical manner is not the best way to go about things. Similarly using standard statistical analysis will yield answers, but not necessarily the right ones. In the previous section I explained how Fourier analysis may be used very effectively to search for periodicity and “power” in a spectrum.

If it seems that a chaotic system is responsible for your data, the best thing to do is to stand back and to try and devise a difference equation set for your system and to see if it mimics your system responses over short time intervals. It may be possible to develop a set of models for the different regimes of the system, using traditional techniques [7]. In future articles (and if there is interest in this, of course), I shall endeavour to develop and present a workflow framework for this.

### 5. Concluding Remarks

From this short introduction, it is clear that chaos is a deterministic process, and that it can only arise in non-linear systems. In many cases the behaviour is so erratic that most statistical tests will tell us that we are dealing with a stochastic process.

The systems have some sort of feedback built in. We know this as we used difference (iterating) equations to demonstrate the concepts. The next state of the system is a function of the current state. Chaos is not a result of sampling errors or noise, but we do know that these systems are very sensitive to changes in initial conditions, which makes prediction of long-term behaviour meaningless. At the same time, short term predictions can be very accurate. And to top it all, we cannot discover the history of a chaotic system by looking at the system in its current state – mathematically such a system has equations that are noninvertible.

Engineers must deal with these type of systems in modern design. Often knowing that the system can behave chaotically in a certain regime is good enough to save time and money, by not trying to develop predictive models for the system for long-term interrogation of the behaviour for example. As we learn more about these systems, we will develop better approaches and tools to deal with them. Being sensitive to the fact that they exist, is an important start.

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### About Jan Roodt

Jan holds a PhD in Engineering Science from the University of Stellenbosch and he is a member of INCOSE South Africa and a registered practicing scientist. In his capacity as Contracts R&D Manager at CSIR in South African he established several new areas of technology research and application for the RSA DoD, including a capability for applied research in Command and Control and an application area focused on modelling and simulation for acquisition decision support (MSADS). Jan moved to Dunedin, New Zealand during 2010 where he started a small consultancy firm focused on environmental systems and project management.

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# Systems Engineering News

## Upcoming Submission Deadlines and Themes for INSIGHT

INSIGHT is the newsletter of International Council on Systems Engineering. It is published four times per year (January, April, July, October). INSIGHT features status and information about INCOSE's technical work, local chapters, and committees and boards. Additionally, related events, editorials, book reviews, trends, and how-to-do articles that are pertinent to the many aspects of a systems engineer's job are also included, as space permits.

Upcoming submission deadlines and themes for INSIGHT

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## Cradle® January 2011 Newsletter

The newsletter describes 3SL's products and services, contain news announcements from 3SL, and discuss topics in requirements management and systems engineering.

More information

## Establishment of INCOSE Reliability Engineering Working Group

Posted by Albertyn Barnard on INCOSE LinkedIn Group

Reliability engineering should be practised as an integral part of systems engineering, yet INCOSE currently does not have a working group on reliability engineering. The possibility of establishing an INCOSE working group on reliability engineering will be discussed at the 2011 INCOSE International Workshop (29 January to 1 February 2011, Phoenix, USA). Interested persons are requested to either attend the scheduled meetings, or to send comments to Albertyn Barnard at ab@lambdaconsulting.co.za.

More information

## U.S. Department of Defense Releases Systems 2020 Request for Information

The Systems Engineering Directorate is leading the "**System 2020**" strategic initiative on behalf of the Office of the Director, Defense Research and Engineering to fundamentally change the capabilities for the design, adaptation, and manufacture of defense systems. Recent conflicts have highlighted the need for DoD to be able to field capabilities and systems to respond rapidly to changing threats. The Department is exploring various approaches as alternatives to the typical practice of fielding systems that respond to specific point requirements that were defined years before the system's initial use. Current requirements-based systems tend to lead to "point solutions" designed to address specific threats, which in turn are assumed to evolve slowly in time. With the pace of events and agility of adversaries, systems of the future need to be far more flexible, adaptable to changing environments, without major redesign, large hardware replacements, or even major software code changes. Systems need to be modifiable or upgradable by reference to virtual models, by plug-replacing subcomponents, or installing new "apps," or upgrading hardware subsystems.

One approach of great interest is the use of engineering methods that enable the development of adaptable systems, supported with tools to enable rapid design changes and rapid fielding. Adaptable systems should be able to counter a broader range of threats and uncertain threat environments than today's defense systems.

To further this approach, the S-2020 initiative is designed to research, develop, and demonstrate engineering tools, technologies, and methods that facilitate the rapid design and manufacture of highly adaptable systems. This initiative is focused on a specific design methodology and a broad class of enabling tools that could make a significant contribution to adaptable system design and development. The design methodology is **platform-based engineering (PBE)**, as defined below, and the entire suite of enabling tools and practices that are intended to foster platform-based engineering are identified as **model-based engineering (MBE)**.

**Platform-based engineering (PBE)** is a design and development methodology that uses components and subsystems as building blocks in an enduring architectural framework to achieve desired functionalities across a broad range of product lines. The architectural framework provides a common core set of features, and the modular design allows for very rapid adaptation of a system to enable new capabilities and features. Further, subsystems should have utility across a number of product lines.

**Model-based engineering (MBE)** employs a model-based (vs. paper-based) approach to system design, capturing design choices and details, and executing the development of the system software and hardware. MBE enhances design reuse and speeds the implementation of design changes. Ideally, MBE allows one to integrate the design of electronics, software, physical structure, mechanical systems, connectors, cabling, hydraulics, and all significant components into a virtual realization of a complex system.

More information

## Systems Engineering

Volume 14, Issue 1 Page 1 - 109

The latest issue of Systems Engineering is available on Wiley Online Library

## NASA ESMD Systems Engineering Paper Competition

Deadline March 7, 2011

NASA's Exploration Systems Mission Directorate is inviting teams of undergraduate and graduate students throughout the

country to participate in the fifth annual systems engineering paper competition. Papers should relate to one of the following areas: Ground Operations, Lunar and Planetary Surface Systems, Propulsion, and Spacecraft.

The deadline to register for the competition is March 7, 2011 and papers are due on March 21st. The winning teams will be announced in April. Awards include up to $3500 in cash scholarships and invitations to attend a future launch at NASA's Kennedy Space Center, Florida.

The competition is designed to engage and retain students in the science, technology, engineering and math, or STEM, disciplines critical to NASA's missions.

For information about the competition and how to register, visit: http://education.ksc.nasa.gov/esmdspacegrant/SystemsEngineering.htm

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## Major Systemic Failures - Prevention Approach Needed

A Purdue University researcher is proposing development of a new cross-disciplinary approach for analyzing and preventing systemic failures in complex systems that play a role in calamities ranging from huge power blackouts to the BP Deepwater Horizon disaster and the subprime mortgage crisis.

"The striking similarities in such catastrophes necessitates a broader perspective to better understand such failures," said Venkat Venkatasubramanian, a professor of chemical engineering. "In the history of systemic failures, a few disasters have served as wake-up calls. The Flixborough chemical plant accident in the United Kingdom in 1974, where a Nypro UK plant explosion killed 26 people, was one such call."

More information

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## Can you Help Create World Class Business Analysts? Submit a Presentation to Business Analysis Forum 2011

Presentation proposals are now being accepted for the Business Analysis Forum 2011, October 30 - November 03 at the Westin Diplomat Resort & Spa, Ft. Lauderdale.

More information

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## WEBINAR - Model-Based Systems Engineering (MBSE) for Improved Efficiency and Affordability

1:30 - 2:30pm EST
Thursday February 24

The United States Government is currently looking for ways to deliver better value to the taxpayer and warfighter by improving how the Department of Defense (DoD) conducts business. One way is to utilize modeling and simulation technology more often when looking to acquire an affordable combat system. This webinar will discuss some ways to implement this strategy by looking at the acquisition of a UAV combat system.

More information

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### INCOSE Systems Engineering Handbook Now at Version 3.2.1

Version 3.2.1 of the INCOSE Systems Engineering Handbook (SEH) was approved in January 2011. The differences between Version 3.2.1 and version 3.2 are small, the result of the approval process for the SEH to become an ISO Technical Report. Either version may be used as the reference for ASEP/CSEP certification; the changes to not affect Certification.

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# Featured Society

## International System Safety Society

The International System Safety Society is a non-profit organization dedicated to supporting the Safety Professional in the application of Systems Engineering and Systems Management to the process of hazard, safety and risk analysis. The Society is international in scope and draws members throughout the world. It is affiliated with major corporations, educational institutions and other agencies in the United States and abroad.

### Objectives and Activities of the Society:

1. Advance the state-of-the-art of System Safety,
2. Contribute to a meaningful managerial and technological understanding of System Safety,
3. Disseminate newly developed knowledge to all interested groups and parties,
4. Improve the public understanding of the System Safety process and discipline,
5. Promote System Safety to all levels of management, engineering and other professional groups,
6. Foster communication within the System Safety profession and with other scientific, legal, public and professional groups,
7. Encourage research into the development and application of new safety management, scientific or engineering techniques
8. Encourage System Safety professional development and education.

### Activities:

Through its local chapters, committees, executive council, publications and publications meetings the Society provides many opportunities for interested members to participate in a variety of activities compatible with Society objectives.

### Service:

The Society provides many unique opportunities for interested members to participate in a variety of activities including such standing committees as Education, Membership, Professional Development, Publications, Public Relations, Standards Development and Conferences.

More information: http://www.system-safety.org

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# INCOSE Technical Operations

## Power & Energy Working Group

http://www.incose.org/practice/techactivities/wg/pande/

### Charter

IWG charter is to bring together builders and operators of infrastructure systems (transportation, energy, and communications) to discuss the application of Systems Engineering.

- Energy (solar, wind, water, coal, nuclear, oil &gas, alternative energies)
- Communications (voice and data)
- Transportation (Land, water, air, space)
- Infrastructure Management
- DOE Facilities

### Leadership

**Chair:** Alain Kouassi

**Co-Chair:** Jan de Liefde

**Comunications Coordinator:** Neil Snyder

Contact Alain.kouassi@incose.org for additional information or to join this group.

### Planned Work

- Assess the State of SE practices in the Infrastructure World
- Assess the State of SE tailored process in each application domain
- Interface with other application sectors
- Investigate INCOSE Events as qualified CEUs for PE\s

### Products to be developed

- SE Life cycle models across areas of practice (Government, Engr Consulting, and Suppliers/Builders)
- Collecting “Best Practices”
- Mapping DOE Guidance to ISO 15288
- Draft MOU between INCOSE and ASCE
- Identify and develop sector-based processes

### Presentations

2008 International Workshop Infrastructure WG Summary Presentation Size: 200K

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# Systems Engineering Software Tools News

## isee systems Live Web Seminar - Exploring Options for Creating Online Simulations

January 25, 2011
1:00 - 1:40 PM EST (Boston Time)
Presented by: Jeremy Merritt, isee systems
Michael Bean, Forio Business Simulations

Learn how to share iThink and STELLA models online

In this 40-minute live web seminar, Jeremy Merritt and Michael Bean will demonstrate how easy it is to create web-based simulations and learning environments. Learn first-hand how to use isee NetSim and Forio Simulate to publish, share and access iThink and STELLA models online.

Space is limited for this FREE event, so register today.

For more information visit www.iseesystems.com or email support@iseesystems.com

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## Atego 1 Day Tutorial - Introduction to Model-Based Requirements Engineering

3 March, 2011 - Bristol, UK

22 March, 2011 - Southampton, UK

24 March, 2011 - London, UK

More information

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## Ravenflow Launches Business Analyst Building Blocks Program

Ravenflow announced a six-part Business Analyst Building Blocks webinar series for 2011. This new education program is designed to help business analysts improve their skills and success with requirements elicitation and management, from initial process discovery to modeling, validation and test. The program kicks off Feb. 22 with a one-hour webinar, “Getting Started with a BA Center of Excellence.”

More information

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## Launch of Artisan Studio ParaSolver speeds the exploration of complex SysML systems design alternatives

Atego has launched Artisan Studio ParaSolver, an invaluable new add-on module for its Artisan Studio award-winning, standards-based, model-driven development tool suite.

Artisan Studio ParaSolver speeds up the whole process of exploring complex SysML design alternatives through the execution of SysML parametric models, enabling optimal system design solutions to be determined quickly and easily.

More information

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## Rommana Integrated Lifecycle Manager New Release

Rommana Software has announced the release of Rommana ALM 11.1. The product supports the following functions:

- Requirement Management
- Test Management
- Project Management
- Use Case Management
- Issue Management
- Change and Release Management.

Release 11.1 adds many features, in areas which include collaboration management, requirements status reporting, and requirements progress reporting.

More information

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# Systems Engineering Books, Reports, Articles and Papers

## Requirements Engineering for Software and Systems

By Phillip A. Laplante
Publisher: Auerbach Publications; 1 edition (March 27, 2009)
ISBN-10: 1420064673
ISBN-13: 978-1420064674

### Product Description

Solid requirements engineering has become increasingly essential to improved on-time and on-budget delivery of software and systems projects. As more engineering programs make it a mandatory part of their curricula, students and working engineers require significant training to master the field, especially the complicated emerging ancillary software tools vital to the requirements engineering process.

With an intentional focus on software-intensive systems, Requirements Engineering for Software and Systems provides a probing and comprehensive review of the state of technology and developments in intelligent systems, soft computing techniques, and their diverse applications in manufacturing.

Topics covered can be applied to the requirements engineering practices for—

- Advanced production machines and systems
- Collaborative and responsive manufacturing systems

- Digital manufacturing
- E-manufacturing
- E-business and virtual enterprises
- Fit manufacturing
- Human machine interfaces
- Innovative design technologies
- Intelligent and competitive manufacturing
- Intelligent planning and scheduling systems
- Mechatronics and MEMS
- Micro and nano manufacturing
- Production automation and control
- Reconfigurable manufacturing systems
- Robotics
- Sustainable manufacturing systems

To illustrate key ideas associated with requirements engineering, the text presents three common example systems: an airline baggage handling system, a point-of-sale system for one location of a large pet store chain, and a system for a "smart home" in which one or more PCs control various aspects of the home's functions. The selected systems encompass a wide range of applications—from embedded to organic, for both industrial and consumer uses.

More information

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## Control Systems Engineering

By Norman S. Nise
Publisher: Wiley; 6 edition (December 14, 2010)
Language: English
ISBN-10: 0470547561
ISBN-13: 978-0470547564

### Product Description:

Highly regarded for its case studies and accessible writing, Control Systems Engineering is a valuable resource for engineers. It takes a practical approach while presenting clear and complete explanations. Real world examples demonstrate the analysis and design process. In addition, helpful skill assessment exercises, numerous in-chapter examples, review questions, and problems reinforce key concepts. Tutorials are also included on the latest versions of MATLAB, the Control System Toolbox, Simulink, the Symbolic Math Toolbox, and MATLAB's graphical user interface (GUI) tools. What if experiments help expand an engineer's knowledge and skills.

### From the Back Cover:

Motivate Students with Real-World Control Systems Emphasizing the practical application of control systems engineering, this 3rd edition with its updated contents will motivate students to learn how to analyze and design feedback control systems that support today's advanced technology. Motivation is obtained through clear and complete explanations of how to design real-world systems. Topics are presented in a logical and progressive way that builds and supports understanding. Whenever possible, new concepts are first presented from a qualitative perspective to help students gain the insight needed to develop sound designs. Next, a detailed discussion of quantitative tools gives readers the ability to design parameters and configurations for systems they will encounter during their career. And with the use of MATLAB®, students will find out how to apply the latest computer methods to the analysis and design of control systems. Key Features of the Third Edition:

- Case studies, using the same system progressively, are integrated throughout the text to provide students with a realistic view of each stage of the control system design process.

- A methodology with clearly defined steps is presented for each type of design problem.
- Numerous in-chapter examples and skill-assessment exercises, as well as end-of-chapter review questions and problems, including a progressive analysis and design problem that uses the same system, are provided.
- An introduction to state-space methods of analysis and design is included. These sections are clearly marked and can be taught along with classical methods, taught separately, or skipped without loss of continuity.
- Tutorials are provided on how to use MATLAB®, the Control System Toolbox, Simulink®, and the Symbolic Math Toolbox to analyze and design control systems. Also included are tutorials on how to use two MATLAB® graphical user interface (GUI) design and analysis tools — the LTI Viewer and the Root Locus Design GUI. All tutorials and MATLAB® code are contained in the text's appendices so as not to detract from the teaching of control systems engineering principles. References to these appendices are provided at appropriate places in the text.
- An accompanying CD-ROM provides valuable additional material, such as stand-alone computer applications, electronic files of the text's computer programs for use with MATLAB®, additional appendices, and solutions to skill-assessment exercises. --This text refers to an out of print or unavailable edition of this title.

More information

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## Customer Service Incorporates Systems Thinking in 2010

Author: Martin Hofschroer

Jo Causon, chief executive of the Institute of Customer Service, told MyCustomer.com that the current climate showed a "renaissance in customer service" as more companies became more aware of consumer needs. Ms Causon said that developments in customer service were shown by the fact that an increasing number of businesses were integrating their service across departments in their organisation. She told MyCustomer: "There is more of a discussion in the boardroom about how we focus on more of a customer-centric strategy rather than it being a bolt-on or just about the delivery aspect." This approach shows signs of systems thinking as the method is a way of helping people view their organisations not only from a customers' point of view, but from a broader perspective and focusing on the whole organisation as a complete system. Using systems thinking is beneficial to a business because it is a powerful approach to improving service or production, reducing failure and mistakes, and eliminating waste at every level of the organisation.

More information

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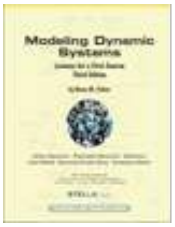
## Modeling Dynamic Systems - Third Edition




By Diana Fisher

Diana Fisher's Modeling Dynamic Systems: Lessons for a First Course, the follow-up to her popular Lessons in Mathematics: A Dynamic Approach, provides a set of tools that enable educators at the secondary and college levels to teach a one-semester or one-year course in System Dynamics. Developed for beginning modelers, the lessons contained in this book can be used for a core curriculum or for independent study.

Updated in 2011, the Third Edition incorporates the latest material that Diana uses to teach her own students.

More information

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## Requirements Engineering: Fundamentals, Principles and Techniques


By Klaus Pohl
Publisher: Springer; 1st Edition. edition (July 23, 2010)
ISBN-10: 3642125778
ISBN-13: 978-3642125775

### Product Description:

Requirements engineering is the process of eliciting individual stakeholder requirements and needs and developing them into detailed, agreed requirements documented and specified in such a way that they can serve as the basis for all other system development activities. In this textbook, Klaus Pohl provides a comprehensive and well-structured introduction to the fundamentals, principles, and techniques of requirements engineering. He presents approved techniques for eliciting, negotiating and documenting as well as validating, and managing requirements for software-intensive systems. The various aspects of the process and the techniques are illustrated using numerous examples based on his extensive teaching experience and his work in industrial collaborations. His presentation aims at professionals, students, and lecturers in systems and software engineering or business applications development. Professionals such as project managers, software architects, systems analysts, and software engineers will benefit in their daily work from the didactically well-presented combination of validated procedures and industrial experience. Students and lecturers will appreciate the comprehensive description of sound fundamentals, principles, and techniques, which is completed by a huge commented list of references for further reading. Lecturers will find additional teaching material on the book's website, www.requirements-book.com.

More information

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## Engineering Mega-Systems: The Challenge of Systems Engineering in the Information Age


By Renee Stevens
Publisher: Auerbach Publications; 1 edition (July 15, 2010)
ISBN-10: 1420076663
ISBN-13: 978-1420076660

### Product Description:

With their ability to cross traditional boundaries and achieve a level of functionality greater than their component elements, mega-systems have helped corporations and government organizations around the world resolve complex challenges that they otherwise couldn't address with stand-alone systems. Engineering Mega-Systems: The Challenge of Systems Engineering in the Information Age provides a clear understanding of the engineering of this class of systems—a process that demands consideration of increasing program scale and the rapid change of underlying technologies.

Written by Renee Stevens, a Senior Principal Engineer at The MITRE Corporation with decades of experience analyzing, engineering, and acquiring large-scale systems for the U.S. Department of Defense and other government agencies, this book explains how the engineering of mega-systems is inherently different from that of large-scale monolithic systems. It supplies the vocabulary and framework needed to explore the issues relevant to mega-systems. This framework then evolves into the Profiler diagnostic tool that helps you understand the nature and context of the system at hand and, on that basis, select the

most appropriate processes, tools, and techniques.

Stevens examines commercial and government applications of mega-systems to provide insight into the contemporary challenges of engineering these systems in three critical dimensions: engineering processes, management processes, and the larger context in which these systems are developed and deployed. Complete with two case studies in engineering mega-systems that illustrate valuable lessons learned and highlight emerging practices, this book supplies the understanding and the tools needed to begin engineering, characterizing, and acquiring mega-systems across multiple dimensions.

More information

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## 10 Useful Ideas on Systems Thinking

By Richard Wilkinson, 2001 – reprinted 11/01/11

“Real life is lived in a complex world system where all the subsystems overlap and affect each other.”

At the heart of systems thinking is the principle of interconnectedness. I compiled the following list to make this core idea translatable to daily life. The ideas presented here are not meant to be the final word on the subject of systems thinking. Indeed, one author listed no less than 28 ideas, a couple of which found their way here, too. This list began in 1995 when the first two entries were shared, appropriately enough, at the conclusion of “The Beer Game”, the famous game developed at MIT to teach systems thinking…..

More information

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## Panarchitecture: Architecting a Network of Resilient Renewal

by Nick Gall - January 24, 2011

Panarchitecture is a kind of hybrid thinking that combines insights and practices from architectural thinking with those from ecological thinking—specifically the ecological thinking known as panarchy. C.S. “Buzz” Holling coined panarchy as the name of his framework for understanding the dynamics of ecosystems. The pan- in panarchy is meant to connote the Greek god Pan, who is associated with both nature and disruption.

More information

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## Systems of Systems: Managing Complexity

By General Gaviard

The term “systems of systems” first appears to be an abstruse acronym, but it actually covers a quite simple reality: the networking of several systems, which will thus be able to exchange information and data in real time. The goal: get a more efficient operational synergy.

Regarding the networking itself, the Americans – who have taken the lead in this area – emphasize the word “NCW” (Network Centric Warfare), while NATO chose that of “NEC” (Network Enabling Capabilities). The semantic difference is rather significant, because in the first case the network is seen as a focal point (“Centric”) within the operational system, while in the second it is identified as a support capacity (“Enabling”) to the operations.

More information

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# Conferences and Meetings

### Being A BA Series - Your Career NEW

Tuesday, March 8, 2011 at 12 p.m. to 1 p.m. EST. *This webinar is for IIBA members only.*
Register now

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### The Sixth International Conference on Systems Engineering in Israel

March 8-9 2011, Herzlia, Israel
More information

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### Spotlight Webinar: Partnering For Project Success - PM and BA Collaboration NEW

Wednesday, March 9, 2011 at 12 p.m. to 1 p.m. EST Join us for this spotlight webinar delivered by Elizabeth Larson from Watermark Learning. As the importance of both business analysis and project management increases, how can the two best work together? Project managers (PMs) and business analysts (BAs) need to build strong working relationships based on respect and understanding of each other's work. A strong partnership between these two roles can significantly increase the likelihood of project success. To facilitate a shared understanding of the roles, the Project Management Institute (PMI) and International Institute of Business Analysis (IIBA) formed a joint committee to review the content of the PMBOK® Guide, Fourth Edition and the BABOK® Guide Version 2.0, as well as to analyze their touch points. Using these bodies of knowledge as a base, the committee looked at knowledge areas, processes, techniques, and hand-offs between the PM and BA. This webinar quickly reviews how the two bodies of knowledge fit together, highlights areas of potential conflict, and presents strategies for a successful PM/BA partnership.

Learning Objectives:

- Briefly describe the key areas of work which are described in both the PMBOK® Guide, Fourth Edition and the BABOK® Guide Version 2.0
- Highlight potential areas of conflict between the BA and PM
- Discuss effective work strategies for BAs to build a strong partnership with the PM

This webinar is open to all.
Register now

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### 2011 International Conference on Systems Engineering and Modeling (ICSEM 2011)

March 11 to 13, 2011, Shanghai, Shanghai, China
More information

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### Resilience 2011 - Resilience, Innovation and Sustainability: Navigating the Complexities of Global Change NEW

March 11-16, 2011, Arizona State University, Tempe, Arizona, USA

More information

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### ABC: Authors, Books and Conversations NEW

Software Requirements, Second Edition, Karl Wiegers

Monday, March 14, 2011 at 12 p.m. to 1 p.m. EDT This month our speaker and author Karl Wiegers will be discussing his book Software Requirements. Software Requirements does not describe a specific methodology for developing requirements. Instead, it presents a tool kit of several dozen "good practices that many organizations have found to be effective when thoughtfully applied". These practices address all five subdomains of requirements engineering: elicitation, analysis, specification, validation, and management. The book includes many examples and stories drawn from actual projects. It describes comprehensive templates that can be used to store business requirements, user requirements, and both functional and nonfunctional software requirements. These templates and many other work aids for business analysts can be downloaded from www.processimpact.com. This webinar is open to IIBA members only.
Register now

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### Second ACM/SPEC International Conference on Performance Engineering (ICPE 2011)

March 14-16, 2011 Karlsruhe, Germany
More information

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### Design, Automation & Test in Europe

March 14-18, 2011, Grenoble, France
More information

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### 26th Symposium On Applied Computing

March 21 - 25, 2011, Tunghai University, TaiChung, Taiwan
More information

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### Requirements Engineering Track – 4th Edition

Part of the 26th ACM Symposium on Applied Computing
March 21 - 25, 2011, Tunghai University, TaiChung, Taiwan
More information

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### ICST Workshop on Requirements and Validation, Verification & Testing (ReVVerT 2011)

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21-25, 2011 (one day), Berlin, Germany
More information

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### Scenario-Based Testing - SCENARIOS 2011

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21, 2011, Berlin, Germany
More information

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### 1st Int'l Workshop on Variability-intensive Systems Testing, Validation & Verification

Co-located with ICST 2011
March 21, 2011, Berlin, Germany
More information

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### 7th Workshop on Advances in Model Based Testing (A-MOST 2011)

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21, 2011 – Berlin, Germany
More information

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### IWEI 2011 - The International Working Conference on Enterprise Interoperability

March 22-24, 2011, Stockholm, Sweden
More information

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### MoBE-RTES 2011 - 2nd IEEE Workshop on Model-based Engineering for Real-Time Embedded Systems

March 28, 2011, Newport Beach, California
More information

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### REFSQ 2011 - 17th International Working Conference on Requirements Engineering: Foundation for Software Quality

March 28-30, 2011, Essen, Germany
More information

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### Being A BA Series - Technical Excellence NEW

Tuesday, March 29, 2011 at 12 p.m. to 1 p.m. EDT This webinar is open to IIBA members only.
Register now

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### Engineering Sustainability Debate NEW

March 30, 2011, City University, London, UK
More information

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### EPICAL - Workshop on Empirical Research in Requirements Engineering: Challenges and Solutions

March 31, 2011, Essen, Germany
More information

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### MBT 2011 - Seventh Workshop on Model-Based Testing

April 2-3, 2011, Saarbrüken, Germany
Satellite workshop of ETAPS 2011
More information

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### GT-VMT 2011 - International Workshop on Graph Transformation and Visual Modeling Techniques NEW

April 2-3, 2011, Saarbrücken, Germany
More information

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### Information Systems Summit II NEW

April 4 – 6, 2011, Hyatt Regency Baltimore, Baltimore, Maryland, USA
More information

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### IEEE International Systems Conference

April 4-7, 2011, Montreal, Quebec, Canada
More information

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### Symposium on Theory of Modeling and Simulation (DEVS/TMS'11)

April 4-9 2011, Boston, MA, USA
More information

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### 1st International Workshop on Model-driven Approaches for Simulation Engineering

Held under the aegis of the Symposium on Theory of Modeling and Simulation, part of the SCS SpringSim 2011 conference.
April 4-9, 2011, Boston, MA (USA)

More information

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### International Symposium on Ambient Intelligence

April 6-8, 2011, University of Salamanca, Salamanca, Spain
More information

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### Workshop on the Reliability of Intelligent Environments (WORIE '11)

within the International Symposium on Ambient Intelligence
April 6-10, 2011, University of Salamanca, Salamanca, Spain
More information

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### International Conference on Operations Research and Statistics (ORS 2011) NEW

April 7-8, 2011, Hotel Equatorial Penang, Malaysia
More information

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### Systems Engineering & Architecting Doctoral Student Network (SEANET) workshop

In conjunction with the 9th Conference on Systems Engineering Research
April 14, 2011, University of Southern California, CA, USA
More information to follow

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### CSER 2011 - Conference on Systems Engineering Research

April 14-16 2011, Redondo Beach Crown Plaza, Redondo Beach, CA, USA
More information

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### 17th International Conference on Information and Software Technologies

April 27th - 29th, 2011, Kaunas, Lithuania
More information

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### Second Annual West Point Critical Infrastructure Symposium NEW

April 29 - 30, 2011, The United States Military Academy in Newark, NJ, USA
More information

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### SETE 2011 – Systems Engineering and T&E

May 2-4, 2011, Rydges Lakeside, Canberra, Australia
More information

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### Software & Systems Engineering Essentials

May 9-10, 2011, Frankfurt, Germany
More information

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### Risk-Based Approaches to Major Decisions (Risk '11)

May 13 - 14, 2011, Falmouth, Cornwall, United Kingdom
More information

### International Conference on Software and Systems Process (ICSSP 2011)

(co-located with ICSE 2011)
May 21-22, 2011, Waikiki, Honolulu, Hawaii, USA
More information

### Sixth Workshop on SHAring and Reusing architectural Knowledge (SHARK 2011)

(co-located with 33rd Int. Conf. on Software Engineering (ICSE 2011))
May 21-28, 2011, Waikiki, Honolulu, Hawaii, USA
More information

### RSP 2011 - IEEE International Symposium on Rapid System Prototyping

May 24 – 27, 2011, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany
More information

### SPICE 2011 - The 11th International SPICE Conference Process Improvement and Capability dEtermination

30 May - 1 June 2011, Dublin, Ireland
More information

### Seventh European Conference on Modelling Foundations and Applications

6-9th of June, 2011, University of Birmingham, Birmingham, UK
More information

### TTCN 3 - 10th Testing & Test Control Notation User Conference

June 7-9, 2011, Bled, Slovenia
More information

### 4th Symposium on Resilience Engineering

June 8-10, 2011, Sophia Antipolis, France
More information

### Security and Privacy Requirements Engineering (SPREE) Workshop NEW

June 15-16, 2011, Carnegie Mellon University, Pittsburgh, PA, USA
More information

### ONTOSE 2011 - 5th International Workshop on Ontology, Models, Conceptualization and Epistemology in Social, Artificial and Natural Systems

June 20, 2011, University of East London - Docklands Campus, London, UK
More information

### BPMDS'11 Working Conference

in conjunction with CAISE 2011

June 20-21 in London, United Kingdom
More information

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### FM 2011: 17th International Symposium on Formal Methods

June 20 - 24, 2011, Lero, Limerick, Ireland
More information

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### The 32nd International Conference on Application and Theory of Petri Nets and Concurrency (PETRI NETS 2011)

11th International Conference on Application of Concurrency to System Design (ACSD 2011)
June 20-24, 2011 Kanazawa Cultural Hall, Kanazawa, Japan
More information

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### INCOSE 21st International Symposium NEW

June 20-23, 2011 Denver, CO, USA
More information

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### Swiss Requirements Day

June 22, 2011, Kongresshaus, Zurich
More information

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### INES 2011 - 15th IEEE International Conference on Intelligent Engineering Systems 2011

June 23-25, 2011, Poprad, High Tatras, Slovakia
More information

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### CoMetS'11 - 2nd International Track on Collaborative Modeling & Simulation NEW

20th IEEE International Conference on Collaboration Technologies and Infrastructures
June 27 - June 29, 2011, Paris (France)
More information

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### SoSE 2011 - 2011 6th International Conference on System of Systems Engineering (SoSE)

Jun 27 - 30, 2011, Albuquerque, New Mexico, U.S.A
More information

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### ICMT2011 - International Conference on Model Transformation Theory and Practice of Model Transformations

Co-located with TOOLS Europe 2011
June 27 - July 1, 2011 - Zurich, Switzerland
More information

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### 15th International Conference on System Design Languages

July 5th - 7th, 2011, Toulouse, France
More information

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### International System Dynamics Conference

July 24 – 28, 2011, Washington, DC, USA
More information

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### 46th Annual International Logistics Conference and Exhibition (SOLE 2011)

August 2011
More information

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### ISSEC 2011 - 3rd Annual Improving Systems and Software Engineering Conference NEW

August 2-5, 2011, Novotel Sydney Brighton Beach, NSW, Australia
More information

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### ISSC 2011 - 29th International System Safety Conference NEW

Aug 8, 2011 - Aug 12, 2011, Las Vegas, Nevada, USA

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### IHMSC 2011 - International Conference on Intelligent Human-Machine Systems and Cybernetics NEW

Aug 26, 2011 - Aug 27, 2011, Hangzhou, China
More information

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### TEAR 2011 : Trends in Enterprise Architecture Research (TEAR) Workshop NEW

August 29, 2011, Helisinki, Finland
More information

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### 19th IEEE International Requirements Engineering Conference

August 29 – September 2, 2011, Trento, Italy
More information

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### International Conference on Industrial Engineering, Systems Engineering and Engineering Management for Sustainable Global Development NEW (Joint with INCOSE SA Annual Conference)

September 21-23, 2011, Spier Hotel and Conference Centre, Western Cape, South Africa
More information

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### Second Annual IIBA Conference

October 2011, More details TBA
More information

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### SASO 2011 - Fifth IEEE International Conference on Self-Adaptive and Self-Organizing Systems NEW

October 3-7, 2011, Ann Arbor, Michigan, USA
More information

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### AGTIVE 2011 - International Symposium on Applications of Graph Transformation with Industrial Relevance

October 4-7, 2011, Budapest, Hungary
More information

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### ACM/IEEE 14th International Conference on Model Driven Engineering Languages and Systems 

October 16-21, 2011, Wellington, New Zealand
More information

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### APCOSE 2011 - Fifth Annual Asia-Pacific Systems Engineering Conference 

October 19-21, 2011, Seoul, Korea
More information

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### NDIA 14th Annual Systems Engineering Conference 

October 24 - 27 2011, Hyatt Regency Mission Bay, San Diego, California, USA
More information

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### SSEE 2011 - Society for Sustainability and Environmental Engineering 2011 International Conference

October 24-26, 2011, Brisbane Convention & Exhibition Centre, Brisbane, Australia
More information

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### ICFEM 2011 - 13th International Conference on Formal Engineering Methods 

October 25 - 28, 2011, Durham, United Kingdom
More information

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### CEBM 2011 - 2011 International Conference on Engineering and Business Management (CEBM2011) 

Oct 28 - 30, 2011, Shanghai, China
More information

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### IIBA 2011 Conference 

Oct 30 – Nov 3, 2011, Fort Lauderdale, Florida, USA
More information

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### 21st Annual Systems Thinking in Action® Conference 

October 31-November 2, 2011, Westin Seattle Hotel, Seattle, WA, USA
More information

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### Complex Systems Design & Management 2011 

December 7-9, 2011, Cité Internationale Universitaire, Paris, France
More information

# Education & Academia

## Systems Modeling Language (SysML) Training - A Quick Start to Model-Based Engineering and Model-Based Systems Engineering (MBE/MBSE)

Georgia Tech and InterCAX jointly offer a SysML quick start training program for professionals wanting to learn the latest about model-based engineering (MBE) in general and model-based systems engineering in particular (MBSE). This comprehensive program covers all four OMG Certified Systems Modeling Professional (OCSMP) certification levels and more. The instructors are subject matter experts who have conducted these short courses for numerous organizations since August 2008 training over 465 professionals. Their distinctions include being involved in OMG SysML development from the beginning, being OCSMP exam authors, conducting leading-edge R&D and MBE/MBSE deployment consulting, and serving as leaders in multiple INCOSE & OMG initiatives.

More information

## DoD Systems Engineering Research Center (SERC)

### Mission Statement

The mission of the Systems Engineering Research Center is to enhance and enable the DoD's capability in Systems Engineering for the successful development, integration, testing and sustainability of complex defense systems, services and enterprises.

As a University Affiliated Research Center (UARC), the Systems Engineering Research Center (SERC) was created to conduct systems engineering research for the Department of Defense (DoD) with the intent of enhancing the definition, synthesis, integration and test, deployment, and support of complex DoD systems and enterprises. SERC will act in four specific areas, providing a research-driven engine for meeting DoD's systems engineering needs:


### Community Development

Lead a national community of SE researchers and educators, focused on DoD challenges.

### Systems Engineering Research

Identify, evaluate, create and integrate SE methods, processes and tools.

### Competency Development

Develop enhanced SE skills and competencies within DoD and industry.

### Governance Development

Build a knowledge base to better assess SE effectiveness and to realize improvements.

The SERC's vision in providing these services is based on three concepts:

### Collaboration

Until the creation of the SERC, there was no single organization with the reach and depth to tackle the kind of systems engineering research needed in our rapidly changing world. Led by Stevens, the SERC collaborators provide a critical mass of systems engineering researchers – a community of broad experience, deep knowledge, and diverse interests. Our researchers have worked with a wide variety of domains and industries, and so are able to bring views and ideas from beyond the traditional defense industrial base. Establishing such a community of focused SE researchers, while challenging, promises results well beyond what any one university could accomplish.

### Innovation

The SERC believes this new community of researchers is an incubator for new and innovative ideas for understanding and improving systems engineering in the DoD space. Innovation is key in finding answers for the critical issues in systems engineering. Some of that innovation will come from cross-discipline research where systems engineering and systems thinking can share ideas with disciplines like biology and sociology where systems are key components. Innovation also includes applying systems thinking concepts to our own research projects and agendas. However, even as we look for new ways, we must integrate the accomplishments and knowledge of the past.

### Practicality

Above all, the research undertaken by the SERC must be useful, applicable to real problems, and relevance the key concerns and challenges of today and tomorrow. Systems engineering is a practice-oriented discipline and so we must remain engaged with those on the front lines of systems definition and development. We will conduct research to discover new ways to approach existing and future problems. Guided by DoD's systems engineering challenges, we see the SERC as an engine for creating solutions that provide ongoing improvement of the defense systems engineering capability through enhanced practices, education, and tools.

More information

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## Summer Courses at Harvard - Systems Thinking

How we explore the challenges we face is often framed by the approaches and strategies we use to examine them. This course in systems thinking assesses system behaviors by examining the entire system – including human, political, community, resource, environmental, and social processes – to get a holistic view into how organizations and individuals often look at the world, assess problems, and invent solutions. And since the way systems are designed determines outcomes, we also look at the intended and unintended consequences of various actions. Using nonlinear thinking to complement our typical linear way of thinking can lead to deeper insight into problems and potential solutions, which is the focus of this course. (4 credits)

More information

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## ISU/Stevens Graduate Certificate in Space Systems Engineering

To respond to the demand for an in-depth technical degree offering, the International Space University (ISU) and Stevens Institute of Technology have joined forces to offer a Graduate Certificate in Space Systems Engineering that can lead to either a Master's Degree in Space Systems Engineering, or a Master's Degree in Systems Engineering with a Graduate Certificate in Space Systems Engineering. Online courses begin in January 2011.Clickhere to enquire or enroll.

Download the PDF flyer: SIT-ISU Systems Engineering Information

More information

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## Immediate Postdoctoral Opening in Systems Requirements Engineering at Masdar Institute

Masdar Institute of Science and Technology has an immediate postdoctoral opening in systems requirements engineering in duration of 1 year (with possibility of extension).

Requirements: PhD with specialization in software engineering, systems engineering, requirements engineering, or computer science and interest in applying your knowledge to advanced energy systems and smart power grids research problems. Strong

programming skills are necessary; knowledge of Matlab or Python and experience in simulation development will give you an additional advantage.

More information

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## Assistant Professor of Systems Engineering (2 Positions)

The Division of Engineering's Systems Engineering Program at Southern Polytechnic State University, Marietta, Georgia (www.spsu.edu) invites applications for two full-time tenure-track positions at the assistant professor level (other ranks considered) to begin in August 10, 2011.

More information

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## Newcastle University: Lectureship in Dependable Architectures

Following excellent results in RAE2008, the School of Computing Science at Newcastle University (UK) is undertaking a second significant investment in new academic posts. If you are a researcher of outstanding promise or with a world-class research record, and your interests and skills align with those that they are looking for, they would like to hear from you.

More information

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## Immediate Postdoctoral Opening in Systems Requirements Engineering at Masdar Institute

Masdar Institute of Science and Technology has an immediate postdoctoral opening in systems requirements engineering in duration of 1 year (with possibility of extension).

More information

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## A research position (Post-doc) is available at the INRIA Rennes Bretagne Atlantique Research Center in the team-project Triskell, Rennes, France

**Title:** Generative Approach for Model Simulation and Properties Analysis Post-doctoral Fellow, INRIA Rennes, EPI Triskell (Université de Rennes 1, Campus de Beaulieu, Rennes)

**Scientific advisor:** Jean-Marc Jézéquel, and supervisor: Benoît Combemale (benoit.combemale@irisa.fr)

During her/his postdoc, the researcher will be considered as a full member of the TRISKELL team. The TRISKELL team is part of the « Institut national de recherche en informatique et automatique » (INRIA), which is one of the leading research center in Computer Sciences in France. The research activities of TRISKELL encompass the whole spectrum of model-driven engineering. The team is member of numerous industrial and academic projects.

Candidates are referred to the TRISKELL website for more information: http://www.irisa.fr/triskell/

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# Some Systems Engineering-Relevant Websites

http://sercuarc.org/

As a University Affiliated Research Center (UARC), the Systems Engineering Research Center (SERC) was created to conduct systems engineering research for the Department of Defense (DoD) with the intent of enhancing the definition, synthesis, integration and test, deployment, and support of complex DoD systems and enterprises.

http://www.millennium-institute.org/courses/courses.html

System Dynamics for Development Planning course

http://www.millennium-project.org/

The Millennium Project was founded in 1996 after a three-year feasibility study with the United Nations University, Smithsonian Institution, Futures Group International, and the American Council for the UNU. It is now an independent non-profit global participatory futures research think tank of futurists, scholars, business planners, and policy makers who work for international organizations, governments, corporations, NGOs, and universities.

http://www.wfs.org/

The World Future Society is a nonprofit educational and scientific organization in Bethesda, Maryland, U.S., founded in 1966. The Society investigates how social, economic and technological developments are shaping the future. It helps individuals, organizations, and communities observe, understand and respond to social change appropriately and investigates the benign effects of applying anticipatory thinking to society.

http://www.systemdynamics.org/

The System Dynamics Society is an international, nonprofit organization devoted to encouraging the development and use of system dynamics and systems thinking around the world. With members in seventy countries, the Society provides a forum in which researchers, educators, consultants, and practitioners in the corporate and public sectors interact to introduce newcomers to the field, keep abreast of current developments, and build on each other's work.

http://www.systems-thinking.org/

Systems thinking website by Gene Bellinger

http://www.systemswiki.org

SystemsWiki endeavors to investigate many things, employing **Systems Thinking** , **Modeling** and **Simulation** to foster understanding.

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# Standards and Guides

## ISO/IEC JTC 1/SC 35 - User interfaces

The JTC1 SC 7 website lists a host of information on this sub-committee. It includes the following list of working groups:

| | |
|---|---|
| JTC 1/SC 35/WG 1 | Keyboards and input interfaces<br>*The convener can be reached through the secretariat* |
| JTC 1/SC 35/WG 2 | Graphical user interface and interaction<br>*The convener can be reached through the secretariat* |
| JTC 1/SC 35/WG 4 | User interfaces for mobile devices |
| JTC 1/SC 35/WG 5 | Cultural and linguistic adaptability<br>*The convener can be reached through the secretariat* |
| JTC 1/SC 35/WG 6 | User interfaces accessibility<br>*The convener can be reached through the secretariat* |
| JTC 1/SC 35/WG 7 | User interfaces object, actions and attributes |
| JTC 1/SC 35/WG 8 | User interfaces for remote interactions |

The SC35 Business Plan for the JTC 1 Plenary, Belfast, UK, 2010-11-08 to 13 provides a management summary, a period review and the focus for next work.

The statement of scope is stated as:
Standardization in the field of user-system interfaces in information and communication technology (ICT) environments and

support for these interfaces to serve all users, including people having accessibility or other specific needs, with a priority of meeting the JTC 1 requirements for cultural and linguistic adaptability.

The work programme for ISO/IEC JTC 1 SC 35 is set out on the ISO website in terms of the standard or project, the Standards Development Process Stage code and the International Classification for Standards (ICS) reference.

More information

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## IEEE Standards Association (IEEE-SA)

The IEEE Standards Association (IEEE-SA) is a leading consensus building organization that nurtures, develops and advances global technologies, through IEEE. They bring together a broad range of individuals and organizations from a wide range of technical and geographic points of origin to facilitate standards development and standards related collaboration. With collaborative thought leaders in more than 160 countries, we promote innovation, enable the creation and expansion of international markets and help protect health and public safety. Collectively, our work drives the functionality, capabilities and interoperability of a wide range of products and services that transform the way people live, work and communicate.

The IEEE-SA is governed by the Board of Governors (BOG) who are elected by IEEE-SA Members. The Board of Governors oversees number of committees that are dedicated to manage key operational aspects of the IEEE-SA. The IEEE-SA Standards Board reports directly to the BOG, and oversees the IEEE standards development process. Standards Board members are elected by IEEE-SA members as a privilege of membership, and all Board Members and Committee members must be IEEE-SA members in good standing.

The IEEE-SA standards development process is open to IEEE-SA Members and non-members, alike. However, IEEE-SA Membership enables standards development participants to engage in the standards development process at a deeper and more meaningful level, by providing additional balloting and participation opportunities. IEEE-SA members are the driving force behind the development of standards, providing technical expertise and innovation, driving global participation, and pursuing the ongoing advancement and promotion of new concepts.

More information

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## Should SC7 Develop Competency Standards

Posted by Tom McBride on ISO/IEC JTC 1/SC7 Software and Systems Engineering LinkedIn Group

More Information

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# Some Definitions to Close On

## Integration, System Integration & System Integrator

### Integration

Integration: The merger or combination of two or more lower-level elements into a functioning and unified higher-level element with the functional and physical interfaces satisfied.
Source: IEEE Std 1220-1994

Integration: Combine parts into a whole
Source: Little Oxford Dictionary & Thesaurus

Integration: (society) The process of fitting into a community, notably applied to 'visible' (ethnic, immigrant...) minorities
Source: http://en.wiktionary.org/wiki/integration

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### System Integration

System Integration: In engineering, system integration is the bringing together of the component subsystems into one system and ensuring that the subsystems function together as a system.

Source: en.wikipedia.org

System integration: The process of connecting systems, devices, and programs together in a common architecture so as to share and exchange data.
Source: www.actc-control.com

System integration: The progressive linking and testing of system components to merge their functional and technical characteristics into a comprehensive, interoperable system.
Source: FS-1037

System Integration: Making diverse components work together.
Source: The Free Dictionary by Farlex

System Integration: The procedures involved in combing separately developed modules or components so that they work together as a complete computer system.
Source: McGraw-Hill Dictionary of Scientific & Technical Terms

System integration: A discipline that combines processes and procedures from systems engineering, systems management, and product development for the purpose of developing large-scale complex systems that involve hardware and software and may be based on existing or legacy systems coupled with totally new requirements to add significant functionality.
Source: McGraw-Hill Science & Technology Dictionary

System Integration: In engineering, the activity of bringing together, during development of a system, the component system elements with the intention of forming a correctly functioning system.
Source: Robert Halligan

System Integration: In engineering, a sometimes-defined stage or phase of system development in which the primary activity is intended to be system integration.
Source: Robert Halligan

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### System Integrator

A systems integrator is a person or company that specializes in bringing together component subsystems into a whole and ensuring that those subsystems function together, a practice known as System Integration.
Source: http://en.wikipedia.org/wiki/Systems_integrator

Abbreviated as SI, an individual or company that specializes in building complete computer systems by putting together components from different vendors. Unlike software developers, systems integrators typically do not produce any original code. Instead they enable a company to use off-the-shelf hardware and software packages to meet the company's computing needs.
Source: http://www.webopedia.com/TERM/S/systems_integrator.html

A contractor hired by an agency to build an electronic toll collection system with various parts supplied by different vendors. Essentially the “prime” contractor.
Source: www.ibtta.org/Information/content.cfm

System integrators provide engineering design, layout, and installation of wireless systems. System Integrators may often be authorized resellers of various system hardware providers (see "System Provider").
Source: www.armstrong.com/commclgpac/asia1/ep/pk/article52294.html

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# Project Performance International News

## CTI Delivers CSEP Preparation 4-Day Course to INCOSE South Africa Members

PPI's subsidiary Certification Training International (CTI) delivered a 4-Day CSEP Preparation Course in Pretoria, South Africa over February 15-18, 2011.

CTI delivers this training publicly in the Netherlands and in the U.S. and on-site worldwide.

More information: www.certificationtraining-int.com

# Project Performance International Events

### Systems Engineering 5-Day Course

Upcoming locations include:

- Sydney, Australia
- Amsterdam, The Netherlands
- London, UK
- Las Vegas, USA

View 2010/2011 Systems Engineering Course Schedule

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### Requirements Analysis and Specification Writing 5-Day Course

Upcoming locations include:

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

View 2011 RA&SW Course Schedule

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### OCD & CONOPS in Capability Development 5-Day Course

Upcoming locations include:

- Adelaide, Australia
- Pretoria, South Africa
- Canberra, Australia
- Brasilia, Brazil

View 2011 OCD/CONOPS Course Schedule

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### Software Development Principles & Processes 5-Day Course

Upcoming locations include:

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

View 2011 Software Development Principles & Processes Course Schedule

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### Cognitive Systems Engineering 5-Day Course

Upcoming locations include:

- Melbourne, Australia
- Tokyo, Japan
- Las Vegas, USA
- Adelaide, Australia
- London, UK

View 2010/2011 Cognitive Systems Engineering Course Schedule

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### Requirements Engineering 5-Day Course

Upcoming locations include:

- São José dos Campos, Brazil

View 2011 Requirements Engineering Course Schedule

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### Introduction to Software Development Principles & Processes 2-Day Seminar

View 2011 Introduction to Software Development Principles & Processes Seminar Schedule

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### Introduction to Cognitive Systems Engineering

Upcoming locations include:

- Melbourne, Australia
- Sydney, Australia
- Singapore

View 2011 Introduction to Cognitive Systems Engineering Seminar Schedule

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### Introduction to Requirements Analysis 1-Day Seminar

Upcoming locations include:

- Brisbane, Australia
- Adelaide, Australia
- Melbourne, Australia

View 2011 Introduction to Requirements Analysis Seminar Schedule

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### Preparing Great Requirements Specifications 1-Day Seminar

Upcoming locations include:

- Brisbane, Australia
- Adelaide, Australia
- Melbourne, Australia

View 2011 Preparing Great Requirements Specifications Seminar Schedule

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### PPI Upcoming Participation in Professional Conferences

- SETE 2011 (Exhibiting)
- INCOSE IS10 (Exhibiting)
- MICSSA (Sponsor/Exhibiting)

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Kind regards from the SyEN team:
**Robert Halligan**, Managing Editor, email: rhalligan@ppi-int.com
**Alwyn Smit**, Editor, email: asmit@ppi-int.com
**Luke Simpson**, Production, email: lsimpson@ppi-int.com

Project Performance International
PO Box 2385, Ringwood, Vic 3134 Australia

Tel: +61 3 9876 7345
Fax: +61 3 9876 2664
Web: www.ppi-int.com
Email: contact@ppi-int.com

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

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