

UTC INSTITUTE FOR
ADVANCED SYSTEMS ENGINEERING

Distinguished Lecture Series

When is complex too complex? Graph energy,
proactive complexity management and the first law
of systems engineering

It is well known that artificial systems that enable modern society to function such as automobiles, aircraft, printing systems, the electrical grid and medical devices amongst others are becoming more and more complex. This complexity often exceeds the cognitive abilities of a single human designer or even that of sophisticated product development organizations. In this talk I will review typical measures of complexity for cyber-physical systems and focus in particular on graph energy as a key measure, independent of the degree of abstraction of the system, to quantify structural complexity. Several invariants such as the P-point, where complexity exceeds a critical threshold, and the importance of the average nodal degree of $\langle 6 \rangle$ will be discussed as important foundations for a more proactive approach to complexity management in the development of cyber-physical systems and the emerging first law of systems engineering: conservation of complexity. I will advocate the establishment of "complexity" budgets similar to mass and power budgets in science and engineering.

Olivier L. de Weck

Olivier ("Oli") de Weck is a full professor of Engineering at MIT and holds degrees in industrial engineering from ETH Zurich (1993) in Switzerland and aerospace systems engineering from MIT (1999, 2001). Before joining MIT he was a liaison engineer and later engineering program manager on the Swiss F/A-18 fighter aircraft program at McDonnell Douglas (1993-1997). His research interests, teaching emphasis and professional experience is mainly in two areas: Systems Engineering for Changeability and Commonality – referred to as "Strategic Engineering" – and Space Exploration Logistics. Prof. de Weck is a Fellow of INCOSE, an Associate Fellow of AIAA, and winner of the 2007 and 2010 Best Paper Award for the journal Systems Engineering, for which he serves as Editor-in-Chief. He has authored or co-authored three books and over 300 research articles in the area of systems engineering. His research has been funded by GM, NASA, BP, JPL, Pratt & Whitney, ArvinMeritor, DARPA, AFRL and the Alfred P. Sloan Foundation, among others.

Thursday October 6, 2016

11:00am - 12:00pm

UConn, Storrs Campus – DODD Center 162

[To view live webcast click here](#)

Upcoming Distinguished Lectures

10/17/16 – Wei Chen
Design of Emerging Engineered
Materials System.

11/28/16 – Masayoshi Tomizuka
Recent Advances in Robot Controls
for Factory Automation.

Upcoming Seminars

11/07/16 – Meaghan O'Neil
Applying Systems Engineering to the
Development of Healthcare
Capabilities

11/28/16 - Masayoshi Tomizuka
Recent Advances in Robot Controls for
Factory Automation

Website:

www.utc-iase.uconn.edu

Email:

utc-iase@engr.uconn.edu

Phone:

860.486.3355



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