

System-of-Systems Modeling for Complex & Adaptive Design of Production Systems

BIOGRAPHY

Dr. Christina Mastrangelo is an Associate Professor of Industrial Engineering at the University of Washington. Her primary research field is systems engineering, quality and risk engineering, predictive analytics and network modeling. Dr. Mastrangelo's research, sponsored by Boeing, Navy, Philips and NIH, seeks to model the effects of lower-level processes on system-level outputs. This is applied to healthcare delivery, system reliability, obsolescence management, manufacturing and food security.



ABSTRACT

In the design and development of complex systems, the effective application of systems engineering principles and advanced modeling techniques are key to adaptive production system design and analysis. Production system performance problems can be traced to early program architecture decisions that place a premium on product attributes and functionality and may not consider business uncertainty, producibility, and supply chain impacts (for example). There is an increasing need for higher levels of performance, reliability, availability, maintainability and safety (RAMS) of the production system that conflict with adaptive principles of resilience, capacity, agility, and degeneracy. Production system efficiency is also frequently at odds with product performance placing additional pressure on both systems to meet stakeholder objectives. These conflicting requirements necessitate new design methodologies and modeling tools to help understand tradeoffs to validate requirements, reduce risk, and assess financial feasibility earlier in the systems engineering process. Often, production system architecture is neglected in the conceptual and preliminary design activities—primarily because it is difficult to model from a method, tool and data perspective. However, viewing the production system as a system-of-systems (SoS), opens-up additional opportunities.