Design for Complex Engineered Systems in the Early Design Phase

By Elham Keshavarzi

Candidate for PhD in Mechanical Engineering

Major Professor: Dr. Christopher Hoyle

Abstract

There are many uncertainties that complex engineered systems will face throughout their lifecycles due to changes in internal and external conditions. It is desirable for complex engineered systems to be resilient against various uncertainties. The ability to overcome such uncertainties should be embedded into the system from the beginning. However, there is a lack of applicable methodology that shows how to design a resilient system from the early design phase. This PhD dissertation introduces a new framework to apply resiliency techniques into the system from the beginning in early design stage to enable the system recovers from failures caused by internal or external uncertainties. We developed an initial functional model using functions, and design structure, as the only information available at the early stage of the design, and simulate the failure behavior of the system. The simulated failure scenarios provide the information on the unique failure propagation paths. A cost-risk model is developed to compare resiliency of different functional models in design space, and produce a preference ranking. The proposed framework is implemented for the design of a monopropellant propulsion system.

Thursday, January 4, 2018

1:00 PM, Rogers 226

School of Mechanical, Industrial and Manufacturing Engineering

Oregon State University