ME/NRE 4725 Probabilistic Risk Assessment (Elective)

Catalog Description

Introduction to a wide range of probabilistic risk analysis and probabilistic design methods for mechanical systems. Topics covered are probabilistic description, sampling methods, risk assessment, and reliability-based design.

Course information

- prerequisites and co-requisites* *MATH 3670 or ISYE 3770*
- *(3-0-0-3) 3 hours of lecture per week, 3 credit hours*

Textbook

- *Seung-Kyum Choi, Robert A. Canfield, and Ramana V. Grandhi, Reliability-based Structural Design, Springer, 2007.*
- Other references:
  - *Modarres, M., Risk Analysis in Engineering: Techniques, Tools, and Trends, CRC Press*
  - *Ang, and Tang, Probability Concepts in Engineering Planning and Design, Wiley*
  - *Haldar, A., and S. Mahadevan, Probability, Reliability, and Statistical Methods in Engineering Design, Wiley, 2000*
  - *Melchers R.E., Structural Reliability Analysis and Prediction, Wiley, 1999*

Course coordinator

Dr. Seung-Kyum Choi

Topics Covered

1) Basic probabilistic descriptions
2) Monte Carlo simulation/Latin hypercube sampling
3) Regression / Analysis of variance
4) Failure modes
5) Probabilistic risk assessment (Levels I, II, and III)
6) System reliability analysis (fault/event tree analysis)
7) Regulation and risk management
8) First/Second-order reliability method
9) Risk-informed decision making.

Course Objectives:

Objective 1: To provide knowledge about probabilistic analysis and risk assessment techniques for applications of mechanical engineering systems

Objective 2: To teach students how to identify, model, simulate, and integrate risk/reliability constraints in engineering design processes

Objective 3: To familiarize students with the fundamentals of modern computer techniques in risk/reliability estimation

Course Outcomes:

Outcome 1: Students will demonstrate understanding of fundamentals of probabilistic analysis and risk assessment methods for mechanical engineering systems.

Outcome 2: Students will demonstrate the ability to mathematically model risk/reliability constraints in various engineering problems using a unified approach.

Outcome 3: Students will demonstrate their ability to use existing computer-based techniques and algorithms for the analysis and design of mechanical systems with the consideration of uncertainty.