ME 597/AAE590: INTRODUCTION TO
UNCERTAINTY QUANTIFICATION
Profs. Alina Alexeenko (AAE), Jayathi Murthy (ME)
1 credit hour
Fridays 3:00 – 3:50 pm BRK 1001
Lecture notes online: http://memshub.org/resources/40

Alina Alexeenko
E-mail: alexeenk@ecn.purdue.edu
Phone: (765)496-1864
Office: ARMS 3231
Hours: by appointment

Jayathi Murthy
jmurthy@purdue.edu
Phone: (765)
BRK 2027
by appointment

Course Outline: The focus of the course is on the quantification of uncertainty in simulations for engineering analysis. Though engineering simulation has become the mainstay of academic and industrial analysis in recent years, there has been little emphasis in understanding and quantifying the source of uncertainty in predictions. These uncertainties may arise for a variety of reasons: lack of mesh-independence, inadequate physical models, uncertainties in geometry, operating conditions and material properties, among others. The course introduces the student to the concepts of verification and validation, sensitivity analysis, and uncertainty propagation using sampling methods, polynomial chaos and reliability based methods. An introduction to uncertainty quantification software is also given. Emerging topics in uncertainty quantification of microsystem simulations are presented. The course is taught as a set of lectures given by Purdue Faculty from the schools of Science and Engineering.

Required Text: None   **Prerequisites:** None.

Grading: Grading will be based on attendance (50%), homework assignments (25%) and a project (25%).

Tentative Schedule:

Week	Topic
1	Intro to Verifiicaton & Validation; Basic Probability and Statistics
2	Linear Sensitivity Analysis; finite difference, sensitivity equation, code differentiation
3	Uncertainty propagation – variance propagation eqn, non-deterministic sampling (Monte Carlo, LHS)
4,5	Polynomial Chaos – Galerkin and collocation
6,7	UQ in computational research examples (guest lectures)
8	Verification and validation of computational models
9	UQ in experiments
10	Using MEMOSA UQ software
11	Introduction to DAKOTA UQ software
12	Reliability methods for uncertainty quantification and validation of models
13	No lecture (Thanksgiving)
14	Uncertainty quantification across scales
15	Epistemic uncertainties and errors; closure