Five Lectures on Uncertainty Quantification

*Wednesdays, April 25–May 23, 4:00 pm, Ryerson 277*

**Professor Jim Berger,** Duke University (Visiting Professor, University of Chicago, Department of Statistics)

**Professor Mihai Anitescu,** University of Chicago, Department of Statistics (and Computational Mathematician, Argonne National Laboratory)

Central to much of science, engineering and society today is the building of mathematical models to represent complex processes. The mathematical modeling and computational science that underlies the development of such *simulators* of processes has seen amazing advances over the last two decades. Yet the simulators themselves are of limited usefulness unless it can be shown that they are accurate in predicting the real process they are modeling. There are a host of statistical issues that arise in developing simulators and assessing their accuracy, an area of research today called *uncertainty quantification* (a somewhat unfortunate name from the perspective of statistics).

This 5-lecture series will provide an introduction to this area. To the extent possible, the lectures will be kept self-contained. They will include numerous examples from engineering and science. The lectures presume a significant grounding in statistics but no specialized knowledge of UQ.

**Lecture 1. Introduction to Uncertainty Quantification**  
*Wednesday, April 25, 4:00-5:00 pm, Ryerson 277; Jim Berger*

We first give an overview of the subject of UQ and then illustrate some of the basic ideas on a simple pedagogical example. This example also serves to highlight the differences between UQ and ordinary statistical analysis of uncertainty.

**Lecture 2. Emulation of Computer Models and Design**  
*Wednesday, May 2, 4:00-5:00 pm, Ryerson 277; Jim Berger*

**Lecture 3. Uncertainty Propagation: Hybrid Sampling – Derivative Methods**  
*Wednesday, May 9, 4:00-5:00 pm, Ryerson 277; Mihai Anitescu*

**Lecture 4. Computer Model Discrepancies and Prediction of Reality**  
*Wednesday, May 16, 4:00-5:00 pm, Ryerson 277; Jim Berger*

**Lecture 5. (CHANGED TO) Reproducibility of Science: P-values and Multiplicity**  
*Wednesday, May 23, 4:00-5:00 pm, Ryerson 277; Jim Berger*