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A New Computational Approach to Inverse Sensitivity Problems

We consider the inverse problem for a map in which we wish to determine the variation in parameters and data that yield an observed or imposed variation on the output of the map. An example of a map is the solution of a differential equation, which maps the space of parameters for the equation to a functional computed from the solution of the equation. We describe the uncertainty in the quantity of interest by a random variable with a given distribution and we seek to determine the corresponding random uncertainty in the inputs.

We describe a new computational method for this probabilistic inverse problem, which we note is ill-posed in general. The method has two stages. Observing that there is a unique inverse from the observed output to the set of (generalized) contours for the output surface, we approximate this unique inverse using the adjoint operator to define approximate piecewise linear generalized contours. We then derive an efficient computational method to use the inverse on the set of approximate contours to compute an approximate probability measure on the input space. Borrowing basic ideas from measure theory, the approximate measure uses a simple function approximation to the posterior density function. We discuss convergence of the method, and explain how to use the method to compute the probability of events in the input (parameter) space. The talk is illustrated with a number of examples.

Thursday, September 3, 2009 ~ 4:10 –5:00 p.m.

Classroom Building ~ Room 310

Please join us for a reception preceding the talk

3:30 ~ 4:00pm @ Ross Hall 223 / Mathematics Lounge

U of Wyoming– Department of Mathematics

Please direct any questions

about the Colloquium to

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