MTH 656

Numerical Methods for Stochastic and Random Differential Equations

Homework 2

Due: May 28

Download `SCcodes.zip` from the course website. Given a deterministic (black box) simulator for a river flow, apply Stochastic Collocation to the random system resulting from a Karhunen-Loeve expansion (KLE) of an ensemble of inflow data in order to determine the expected maximum Water Stage Elevation (WSE) at 250 meters downstream.
In particular,

- Use 2 terms of the KLE in order that 95% of the variance is retained.
- Assume uniform random variables in the KLE (note that this violates the independence assumption) so as to avoid negative inflows and to make the formation of the sparse grid easier. Since the random variables must be zero mean and unit variance, they are both distributed as $\mathcal{U}[-\sqrt{3}, \sqrt{3}]$.
- Use Clenshaw-Curtis nodes (in 2D), both full tensor and Smolyak sparse grids.
- Use `parfor` if you have it.

See `SCdriver.m`. See also Saint-VenantEquations.pdf for a description of the simulator if you are interested.

1. Comment on the runtime for each grid. How does this change with increasing level?
2. Comment on the accuracy of each method for various levels (as compared with the highest level you run).