HW 3
Due April 11, 2011

Solve a stochastic diffusion equation $\frac{\partial u}{\partial t} = \mu(\omega)\frac{\partial^2 u}{\partial x^2}$ where u is some wave which diffuses over time "t" in space "x", 0<=x<=L, 0<= t <= T . The diffusivity coefficient is a stochastic parameter and it is always positive.

You may use <u>any</u> (stable) discretization method, implicit or explicit and boundary conditions (Newman, Dirichlet or periodic).

The stochastic parameter "omega" can be randomly chosen (Monte-Carlo simulations) or it can obtain values of the roots of polynomial function (more efficient approach).

We are interested in the mean solution $\overline{u}(t,x)$ and standard deviation which are obtained from $u(t,x,\omega)$:

$$\overline{u}(t,x) = \sum_k u(t,x,\omega_k) w_k$$

$$std(u) = \sum_k [u(t,x,\omega_k) - \overline{u}(t,x)]^2 w_k$$

Requirements:

1. Code must be
a) parallel
b) employ two level of parallelism – the domain should be split in the direction of a stochastic variable "omega" and space variable "x".
c) you may use MPI or OpenMP (or hybrid) program to obtain solution for each stochastic variable "omega_k" . Here you may reuse the solver you have written for the HW2. You may also use GPUs for solution of deterministic equation.

2. Test for accuracy of the deterministic solver is required.

3. Test and report the performance of your code.

4. In your report you should include a pseudo code showing the different steps of the solver, you can use block diagrams or other techniques to describe on the top level what and how your code is working.

5. Explain the design of IO.

6. you may work in pairs.