CS 491/591 Numerical Optimization - Project #1 Due Sept 20th

September 8, 2006

Implement the following objective function in the navier2d.m code:

$$\min_{\mu} f(x) = \sum_{i=0}^{N} (u - u^*)^2 \tag{1}$$

where μ is viscosity, u is the simulated velocity in the x-direction, and u^* is the target velocity in the x-direction, N is the number of output locations. Note: you are not asked to solve the minimization problem, only to instrument the objective function and instrument the facility to perturb the viscosity.

To get the target values, run navier2d in the forward mode for a given μ and extract velocity values in the x-direction u from at least 5 random locations in the mesh (make sure you retain the x and y locations to be used later in the objective function calculation).

Try 5 different values of viscosity values and report the corresponding objective functions. Determine if the behavior of the objective function has sufficiently smooth behavior for use in a gradient based optimization problem by perturbing any given initial viscosity value with 10 systematic perturbation increments. Plot the objective function versus the values of viscosity. Experiment with three different values of the perturbation increment.

Requirements:

- email tar file with code, results and documentation to bartv@sandia.gov and add in subject line "UNM 591 Project 1". Also, name your tar file as follows: student-lastname_proj1.tar
- label your code extensions with your initials, so that I can easily identify your extensions and modifications
- provide a brief description of the code modifications
- include results and conclusions of determination of smoothness of objective function

Note: the preferred docomentation software is latex (with dvi, ps or pdf output)