Meeting: 1006, Lubbock, Texas, SS 11A, Special Session on Future Directions in Mathematical Systems and Control Theory

1006-49-60 **Sandro Manservisi*** (smanserv@math.ttu.edu), Texas Tech University, Mathematics and Statistics Department, Lubbock, TX 79416. *Vanka-type solvers for steady Stokes and Navier-Stokes optimality systems.*

In this work, we study a class of optimal flow control problems and its multigrid implementation for which the fluid motion is controlled by velocity forcing, i.e., injection or suction, along a portion of the boundary, and the cost or objective functional is a measure of the discrepancy between the flow velocity and a given target velocity. Optimal control computations with distributed and boundary controls are presented by using a new multigrid approach. The multigrid solver is based on a local Vanka-type solver for the Navier-Stokes and the adjoint system. The class of Vanka-type smoothers is characterized, in each smoothing step, by the solution of small local linear systems of equations in a Gauss-Seidel manner. In each iteration step this smoother requires the solutions of several small local subproblems over finite element blocks. The solution is achieved by solving and relaxing element by element the optimal control problem. It is shown that for particular blocks of finite elements the algorithm converges always to the solution of the Stokes problem and under suitable conditions to the solution of the Navier-Stokes problem. The convergence properties are analyzed for the finite elements formulation and numerical examples are presented. (Received February 01, 2005)