Dalia Fishelov
Afeka Tel Aviv Academic College of Engineering

An embedded Cartesian scheme for the Navier-Stokes equations

In this talk the two-dimensional Navier-Stokes system in stream function formulation is considered.

We describe a fourth-order compact scheme for regular domains in 2D. We then proceed to irregular domains. First, the irregular domain is embedded in a Cartesian grid. Then, an interpolating polynomial is built for regular elements inside the domain as well as for irregular elements near the boundary.

A compact high-order scheme is then constructed for the Navier-Stokes equations by applying the differential operators involved in the Navier-Stokes equations to the interpolating polynomial.

Numerical results will be presented for various irregular domains. A particular attention is devoted to flows in elliptical domains. In the case of the ellipse, we also demonstrate the ability of the scheme for computations of the eigenvalues and the eigenfunctions of the biharmonic problem on the ellipse.

Joint work with Matania Ben-Artzi and Jean-Pierre Croisille.