Netscape: HPF Application Kernel – Solution of 2-D Poisson Equation by ADI

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Code Title:

Solution of 2-D Poisson Equation by ADI.

Purpose:

This code illustrates the use of HPF constructs for fluid dynamics problems. The time dependent Navier-Stokes equation can be written in terms of the vorticity and stream functions by the coupled equations:

$$\frac{\partial \zeta}{\partial t} = \frac{1}{\mathbf{Re}} \nabla^2 \zeta + \left(\frac{\partial(\psi)}{\partial y} \frac{\partial(\zeta)}{\partial x} - \frac{\partial(\psi)}{\partial x} \frac{\partial(\zeta)}{\partial y} \right)$$

and

$$\frac{\partial \psi}{\partial t} = \nabla^2 \psi - \zeta$$

The code here solves the simpler second equation, in terms of the stream function, for a given fixed vorticity.

Noteworthy Features of the Code:

The code is parallelised by splitting each time step into two, with the x and y directions solved in alternating half-steps. In each of these half-steps, lines across the physical domain are solved in parallel. Parallelism is achieved via the INDEPENDENT HPF directive over the parallelised direction.

This requires the HPF directive REDISTRIBUTE to be used to change from the two directions of parallelism.

Documentation

This work and the HPFA project was presented at the 1995 European Conference on High Performance Computing and Networking, May, in Milan Italy. The postscript version of this is available.

Implementation and Performance Issues

- F77 Source (not available)
- F77 with Message Passing Source (not available)
- F90 Source
- HPF Source

Document: Done.