Re: Questions about boundary conditions..

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- *Date*: Mon, 15 Jan 2007 11:55:26 +0000 (UTC)

In article <ENWdnf72HKddkTXYRVnyrAA@xxxxxx>,
"Jeff" <Jeff_nospam_for@xxxxxxxxxxxxx> writes:

> Hello, could I post another question...
>
> Suppose we have a 5 point finite difference implementation of a solver for Laplaces equation in 2D and we have a solution on a very large (tending to infinity) rectangular domain with either Dirichlet or Von Neumann boundary conditions.
>
> Is it possible to solve a sub−domain of the larger domain such that the solution on the smaller problem is the same as the larger problem? If so what boundary conditions should be applied to the sub−domain. I've seen reference to "absorption" boundary conditions − what would these correspond to in this context? My inclination is to try to set the gradient normal to the boundary to be continuous but I haven't been able to make this work satisfactorily so far.
>
> Also, what are the limitations on the shape of a boundary for this type of (2D) finite difference problem − for example does it have to be strictly convex or even rectangular? I'm trying to solve on quite irregular regions and often get strange behaviour at certain boundary points.
>
> Thanks for any help.
>
> Jeff

construction depends strongly on the equation type.
there are lots of papers about this
typically connected with pecial equations (maxwell, schroedinger,
geenral hyperbolic systems, reaction diffuson..)

I add some references only

J. P. Berenger, "A perfectly matched layer for the absorption of electromagnetic waves," J. Comp. Phys., vol.114, no.2, Oct. 1994, pp.185−200.

J. P. Berenger, "Three−dimensional perfectly matched layer for the absorption of electromagnetic waves," J. Comp. Phys, vol.127, no.2, Sept. 1996, pp.363−79.

Halpern, L.
Absorbing boundary conditions and optimized Schwarz waveform relaxation.
BIT 46, Suppl., S21−S34 (2006).

Hu, Fang Q.
Absorbing boundary conditions. (English)
Int. J. Comput. Fluid Dyn. 18, No. 6, 513−522 (2004).

but especially for the laplace equation I found no references.

what concerns general boundaries for the finite difference method,
there is no restriction (besides the usual one from theory: having a Lipschitz domain) but you will need to use tricky interpolation methods especially for the von Neumann case (for example you need to compute the intersections of the normal to the boundary with the given rectangular gridlines, define an interpoation process on these intersections and then express those intersections with
the grid data. In older books this is described in detail, but
finite differences on geenral domains is now superseded by the much easier to apply finite elements.
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peter

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