

Re: request for algorithm

Source: <http://sci.tech-archive.net/Archive/sci.math.num-analysis/2006-01/msg00080.html>

- *From:* loic-dev@xxxxxxxx
 - *Date:* 12 Jan 2006 00:29:17 -0800
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Hi,

> Hi everybody, I am really desperate on this and would certainly appreciate
> any recommendations/suggestions. I am looking for practical problems
> that can be solved by means of N-dimensional iterative algorithms,
> $N \geq 3$ (e.g. 3D space domain, 2D space domain+time domain, 3D space
> domain+time domain etc), where in each iteration one computes the value
> at a point $U(x,y,z,...)$ with the aid of "previous" points. For instance,
> $U(x-1,y,z,...)$, $U(x,y-1,z,...)$, $U(x-1,y,z-1,...)$, $U(x,y-2,z-3,...)$ are
> all welcome, but e.g. $U(x+1,y,z,...)$, $U(x-1,y+1,z,...)$ are not. Any
> algorithm name/URL/physical problem will do, I am willing to delve into
> the details myself.

I could eventually understand why you don't want to have a forward reference in time (you would have to solve a system of equations). But I can't really understand why you don't want to depend on the points $U(x+1,y,t)$, $U(x,y+1,t)$ for instance...

What is the problem you are faced to, exactly?

> For instance, I have been looking into time/space discretizations of
> initial value problems/boundary value problems, such as the Poisson
> equation, but when using only previous points convergence gives me
> a rough time. I really don't mind reduced accuracy of the one-sided
> discretization compared to a central alternative one, as long as the
> algorithm ensures convergence. Any ideas?

As already pointed out by Peter, such scheme can only work with particular equation, that has a flow of information coming from the points $x-k$, $y-m$, $t-l$ with $k,m,l > 0$.

This can't be the case e.g. for elliptic equation like the Poisson equation, because by nature the flow of information comes from every direction (hence, you need value at $x+k,y+m$). Of course, you can always use an explicit discretization in time (e.g. the value at time t is computed with the values at previous times $t-l$), but you will need value of $U(x+k, y+m, t)$

HTH,
Loic.

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