1046-35-1102 **Alex Vladimirsky*** (vlad@math.cornell.edu), 430 Malott Hall, Department of Mathematics, Cornell University, Ithaca, NY 14853-4201. *Causality, dimensionality, efficiency.*

The "direction of information flow" is a natural notion well-defined for a variety of problems, including those in front propagation, optimal control & differential games. "Causal" numerical methods mimic this property of underlying PDEs to ensure the computational efficiency.

One obvious example is time-dependent PDEs where the information flows from the past into the future. Explicit time-marching methods take advantage of the corresponding causal ordering of gridpoints in time-space domains. For boundary value problems, a simple causal approach is to embed the original n-dimensional static problem into R^{n+1} by adding time-dependence, but raising dimensionality also affects the computational cost. Computation of multivalued solutions to first-order PDEs is another problem where the interaction between causality, dimensionality & efficiency is far from trivial. (The original problem in R^n is often restated & solved in a (2n+1)-dimensional phase space.)

We will discuss several problems for which causal methods can be built without increasing the dimensionality & one "static" problem (in multi-objective optimal control) where the increase in dimensionality is natural/unavoidable & the causality of computations is a pleasant side-effect. (Received September 14, 2008)