Efficient and Accurate Local Time Stepping Algorithms for Multi-rate Problems

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October 23, 1997

On the Wednesday, Oct. 22, 1997 Dr. Jianping Zhu, who is professor in the Department of Mathematics Mississippi State University, gave us talk of "Efficient and Accurate Local Time Stepping Algorithms for Multi-rate Problems".

First, he said, during the past years they did researches in the multi-rate problem which is described by a system of coupled partial differential equations with different time scales associated with differ equations in the system. Local time stepping can be used to improve the efficiency of explicit algorithms. The basic idea is to advance solutions at different spatial grid points using different time steps determined by the local stability conditions. The difficulty with this approach is that if the transition between the solutions obtained using different time steps is not handled properly, the consistency in the temporal dimension will be lost, making the local time stepping algorithms useful only for steady state calculations.

He said that using explicit method to solve difference equation is easy for implementation, parallelization, but it is conditional stable. Using implicit method to solve difference equation is difficult for implementation, parallelization, but it is unconditional stable. So, using multi-rate with different time scales makes fast to solve problem and get more accuracy.

Finally, he shows us some examples by graph.