PARALLELIZATION OF AFDM

Parallelism:

- Data parallelism across the computational domain
- Task parallelism within a local partition

Issues/Requirements:

- Data-Structure
- Communication Requirements
- Distribution Strategy
- Dynamic Load-Balancing

Department of Computer Sciences & Center for Relativity • University of Texas at Austin
Austin, TX 78712-1081
Tel: (512) 471-1103; Fax: (512) 471-0890

Data-Structure Requirements

Distributed, dynamic DAG of multi-dimensional grids

- Dynamics:
  $\Rightarrow$ levels of the DAG
  $\Rightarrow$ number of grids per level
  $\Rightarrow$ size, shape, location of a grid
- Grid nesting
- Grid clustering/partitioning

Communication Requirements

Intra-Grid Communications

- Near-neighbor exchanges based on the differencing operator
- Regular - can be overlapped with computation on the interior of a grid partition

Inter-Grid Communications

- Prolongations, Restrictions
- Gather/Scatter operations
- Expensive - can lead to bottlenecks

Random communication

- Required for clustering, maintaining grid nesting, load balancing
- Nature depends on decomposition strategy

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Distribution Requirements

- Maximize parallelism
- Minimize communication overheads
- Balanced work distribution
- Minimize re-distribution overheads
  - fast, parallelizable, incremental

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