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Parallel Adaptive Wavelet Collocation Method for PDEs[1] OLEG V. VASILYEV, ALIREZA NEJADMALAYERI, ALEXEI VEZOLAINEN, University of Colorado at Boulder — A parallel adaptive wavelet collocation method for solving a large class of Partial Differential Equations is presented. The parallelization is achieved by developing an asynchronous parallel wavelet transform, which allows to perform wavelet transform and derivative calculations on each processor without additional data synchronization on each level of resolution. The data are stored using tree-like structure with tree roots starting at sufficiently large level of resolution to shorten tree traversing path and to minimize the size of trees for data migration. Both static and dynamic domain partitioning approaches are developed. For the dynamic domain partitioning, trees are considered to be the minimum quantum of data to be migrated between the processors. This allows fully automated and efficient handling of non-simply connected partitioning of a computational domain. Dynamic load balancing is achieved via domain repartitioning during grid adaptation step and reassigning tree data structure nodes to the appropriate processors to ensure approximately the same number of nodes on each processor. The parallel efficiency of the approach is discussed based on parallel Coherent Vortex Simulations of homogenous turbulence with linear forcing at effective non-adaptive resolutions up to 2048^3 using as many as 1024 CPU cores.

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