Adaptive Multilevel Finite Element Method for Fractional Differential Equations using Hierarchical Matrices

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In this talk, we consider the development of the adaptive multilevel finite-element methods for fractional differential equations (FDEs). We use hierarchical matrices to represent the dense stiffness matrices resulting from the finite-element discretization of the FDEs on nonuniform meshes and apply geometric multigrid method to solve the linear system of equations. Recovery type a posteriori error estimator is used to design adaptive algorithm in order to deal with the singularities of the solutions. Numerical experiments are presented to demonstrate the efficiency and robustness of the proposed adaptive multilevel method, which resolves singularities accurately with a nearly linear computational complexity.