MULTILEVEL ACCELERATED OPTIMIZATION FOR PROBLEMS IN GRID GENERATION

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The quality of numerical simulations of processes that are modeled by partial differential equations strongly depends on the quality of the mesh that is used for their discretization. This quality is affected, for example, by mesh smoothness, or discretization error. To improve the mesh, a functional that is in general nonlinear must be minimized (for example, the L^2 approximation error on the mesh). This minimization is constrained by the validity of the mesh, since no mesh folding is allowed. Classical techniques, such as nonlinear CG, perform very poorly on this class of minimization problems. We will introduce a new minimization technique that utilizes the underlying geometry of the problem. By coarsening the mesh successively, in a multilevel-like fashion, minimizing appropriate coarse grid quality measures, and interpolating finer meshes from coarser ones, a more rapid movement of fine mesh points results, and the overall convergence of the minimization procedure is accelerated.