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Applications and Recent Developments of Multilevel Optimization Framework(MG/OPT)

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This talk will present recent progress related to the theory and applications of the multilevel optimization approach MG/OPT. Inspired by the traditional multigrid, the intent of MG/OPT is to use calculations on coarser levels to accelerate the progress of the optimization on the finest level. There are several advantages of MG/OPT: first of all, the optimization perspective is broader than systems of equations since it can handle the constraints in a more natural way. Also, MG/OPT has stronger guarantees of convergence than traditional multigrid. Furthermore, in many cases the reduced Hessian of the optimization model is an elliptic operator making MG/OPT an effective algorithm. So far, MG/OPT has been successfully applied to many PDE-constrained optimization problems which have regular geometric structures. However, in practice, more sophisticated implementations that provide an easier way to apply MG/OPT to specific problems are still under exploration. In order to investigate the potential of MG/OPT to solve the problems with irregular geometric structures, MG/OPT is applied to a particular type of tessellation problems called centroidal Voronoi tessellations(CVTs). Significant speedup by using MG/OPT comparing to other existing techniques has shown.

Furthermore, the constrained version of MG/OPT has also been developed and it has been applied to successfully solve a variety of other constrained optimization problems.