TECHNOLOGY

Kriging Metamodel Assisted Multi-Objective Optimization Software

OVERVIEW

Although population based optimization methods, such as multi-objective genetic algorithms (hereinafter; “MOGAs”), have become very popular for engineering optimization problems because of their flexibility, the high computational cost associated with this type of methods has been preventing applications of these methods to more realistic engineering design problems due to the large number of simulation calls used to evaluate designs. Thus, the main challenge here is to devise methods that can significantly reduce the number of simulation calls (i.e., objective/constraint function calls) required by these optimization methods. A common strategy for genetic algorithm based optimization methods is to use metamodeling along with the simulation models. On-line (i.e., initializing, updating, and validating of metamodels, all embedded within the optimization) approaches that use a combination of metamodeling with the actual simulation model during the optimization procedure while adaptively improving the metamodel have been reported in the literature. However, most of these on-line methods are focused on single-objective optimization. Another unresolved issue in the current on-line methods is how to objectively decide when to switch to metamodel instead of the simulation model, during the optimization procedure.

Researchers at the University of Maryland have developed a new multi-objective design optimization approach “K-MOGA” in which the Kriging-based metamodeling is embedded within a MOGA. The key difference between the conventional MOGA and K-MOGA is that in K-MOGA some of the design points are evaluated on-line using Kriging metamodeling instead of the actual simulation model. The decision as to whether the simulation or its Kriging metamodel should be used for evaluating a design point is based on a simple and objective criterion. The results show that on the average K-MOGA converges to the Pareto frontier with an approximately 50% fewer number of simulation calls compared with a conventional MOGA. K-MOGA is applicable to the engineering optimization problems with the following properties: 1) the problem can have multiple objective functions with mixed continuous-discrete design variables; and 2) functions used to evaluate designs in the problem can be black-box simulations.

For additional information, please contact the Office of Technology Commercialization, University of Maryland College Park, via phone at (301) 405 -3947 or e-mail at otc@umd.edu.

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Additional Information

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

Contact OTC for licensing information

CATEGORIES

- Software + Algorithm
- Information Technology
- Engineering

EXTERNAL RESOURCES

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