The Application of SPTA in Large-Scale Complex Engineering Optimization

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Abstract

In a traditional co-optimization, decomposition algorithms and surrogate model methods are commonly used to solve large-scale complex optimization problems. In this case, the samples of surrogate model have to be calculated repeatedly in different iteration loops, which greatly reduces the computational efficiency. It is found from a mathematical deduction that the difference of sample points between iteration loops is a simple function related to the inter-group dependent variables, which benefits the complexity-reduction of the original optimization function. Based on the above finding, a method named sample point transformation algorithm (SPTA) is proposed to improve the calculation efficiency by calculating few samples to transform the whole sample set between iteration loops. A few typical numerical examples together with an engineering optimization example were employed to validate the calculation efficiency, which is improved by around 75% while guaranteeing the optimization accuracy, indicating the advantage of this SPTA in large-scale complex engineering optimization problems.

Keywords: Co-optimization, large-scale, decomposition, surrogate model, complex engineering optimization