SURROGATE BASED OPTMIZATION USING KRIGING

WITH

APPLICATIONS

By

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A Thesis submitted to the Faculty of Engineering at Cairo University

In Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

in

ENGINEERING MATHEMATIC

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

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Abstract

Optimization plays an important role in the design of engineering systems. The target of engineering optimization is to determine the nominal values, of the system parameters, that satisfy certain design specifications (constraints) while achieving some optimization objectives such as cost reduction, improved performance and enhanced reliability. In general, optimization of engineering systems is of great challenge, as the computational effort required during the optimization process forms an obstacle for achieving a good design. The problem is treated efficiently by using a surrogate model (approximation) of the exact model. A surrogate model is a mathematical or physical model which can take the place of an expensive exact model for the purpose of modeling or optimization of the latter. One of these methods is of great importance to the engineering optimization society, mainly, the Kriging surrogate based optimization.

Kriging models are statistical models that are widely used in engineering optimization. The Kriging model is constructed with a few number of function evaluations and it is continuously updated during the optimization process by including more sample points until the optimal solution is obtained. Kriging is an exact interpolator and more accurate approximation over a wide range of samples size and design.

The work represented in this thesis is about using the Kriging surrogate models in the engineering optimization. Two proposed methods for using Kriging models are introduced. The proposed methods are applied on a set of classical bench-mark test examples. In addition, they are applied to some practical stochastic optimization problems in which the objective function has an expectation form, namely in the design of microwave circuits. The results show that the proposed methods provide good results with small number of function evaluations.