ABSTRACT

Metamodeling of High Dimensional Models Using Sequential Adaptive Radial Basis Function

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Computer based experiments, such as simulation and analysis, are widely used in current engineering field in lieu of physical experiments using prototypes. As the capability and speed of computer is improved, computer based experiments of an engineering system are readily made. However, the simulation or analysis that might take several minutes to hours for a run of a complex model requires high computational expense, and it limits design optimization and reliability analysis using computer based experiments.

Metamodel that is approximation model is used for replacing the expensive computer based experiments. However, for the models with many design variables and

high complexity, even metamodeling causes many problems in terms of accuracy, efficiency and ease of implementation.

In this paper, in order to generate metamodels for high dimensional models effectively, a new sequential metamodeling technique is proposed. Sequential set sampling technique is introduced to sample additional sample points as a set that is more effective for high dimensional models. Radial basis function, which uses the generalized multiquadric basis function, is utilized as the approximation model. The adaptive parameters of radial basis function is computed by using the additional sample set as the test sample set of the current radial basis function. Therefore, the accuracy of the radial basis function is increased. Consequently, accuracy of the radial basis function is assessed efficiently in the process of generating the adaptive radial basis function without using additional confirmation points. To substantiate the proposed method, two mathematical models including 10 design variables are applied to verify the accuracy and hollow I-beam problem including 30 design variables, the simplified component model of an aircraft, is examined to check the efficiency for the practical use in engineering models.