Applicability and Comparison of Surrogate Techniques for Modeling Selected Heating Problems

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Abstract

Possibility of using surrogate techniques for modeling selected strongly nonlinear heating problems is investigated. The main purpose is to significantly reduce the computing time in the case of calculations of many different variants of a given task by the finite element method on the condition of obtaining results of a still acceptable accuracy. Frequently used surrogate techniques (based on kriging, neural network etc.) are tested on the problem of laser welding that represents a very complicated 3D problem. Here, the most important output quantities are the structure of weld and its depth that depend on a number of input parameters (power of laser beam, velocity of shift of the welded parts, overall geometry and material properties etc.) and must be known before welding itself. The paper presents both full model of the proces and considered surrogate algorithms, and compares the results obtained. It is shown that careful selection of the surrogate technique together with suitable choice of its input data is very beneficial and may result in high savings in design of the process. Evaluated is also implementation performance and suitability of particular techniques of this kind.

References

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