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Line Heating Forming: Methodology and Application Using Kriging and Fifth Order Spline Formulations

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Abstract : In this article, a method is presented to effectively estimate the deformed shape of a thick plate due to line heating. The method uses a fifth order spline interpolation, with up to C3 continuity at specific points to compute the shape of the deformed geometry. First and second order derivatives over a surface are the resulting parameters of a given heating line on a plate. These parameters are determined through experiments and/or finite element simulations. Very accurate kriging models are fitted to real or virtual surfaces to build-up a database of maps. Maps of first and second order derivatives are then applied on numerical plate models to evaluate their evolving shapes through a sequence of heating lines. Adding an optimization process to this approach would allow determining the trajectories of heating lines needed to shape complex geometries, such as Francis turbine blades.

Keywords : deformation, kriging, fifth order spline interpolation, first, second and third order derivatives, C3 continuity, line heating, plate forming, thermal forming
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