Isogeometric collocation methods for thermal analysis with general internal heating sources

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Isogeometric Analysis (IGA) was first introduced in 2005 as an alternative method for finite element analysis (FEA) by integrating Computer Aided Design (CAD) and downstream analysis without the use of an intermediate mesh model [1]. Most IGA researches are either based on Galerkin or collocation formulations. Isogeometric collocation methods provide the potential to increase the computational efficiency of isogeometric analysis with a specified level of accuracy. Some research works on collocation-based IGA can be found in [2, 3, 4]. Collocation-based IGA has been applied to various applications including the solution of partial differential equations. This study presents an investigation of collocation methods for isogeometric analysis in thermal applications using non-uniform rational B-splines (NURBS). Examples on thermal analysis with Neumann and Dirichlet boundary conditions have been conducted in comparison with an existing FEA software ANSYS. In addition, thermal analysis with various general internal heating sources has also been conducted using isogeometric collocation methods. Typical internal heating sources include discrete point heat sources, curve-shaped heating sources and area-shaped heat sources. The proposed method has been applied for the simulation of selective laser sintering for 3D printing and can also be applied for any other simulations with general internal heating sources.

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