6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

A posteriori error estimates for generalized finite elements in transient heat diffusion problems.

Muhammad Iqbal[1], Heiko Gimperlein[2], M. Shadi Mohamed[1] and Omar Laghrouche[1]

[1] Institute for Infrastructure and Environment, Heriot–Watt University, Edinburgh, EH14 4AS, United Kingdom, {mi130, m.s.mohamed, o.laghrouche}@hw.ac.uk
[2] Department of Mathematics, Heriot–Watt University, Edinburgh, EH14 4AS, United Kingdom, h.gimperlein@hw.ac.uk

Key Words: *Heat transfer, generalized finite elements, a posteriori error estimate, time domain.*

We propose the study of a posteriori error estimates for time–dependent generalized finite element simulations of heat transfer problems. A residual estimate is shown to provide reliable and practically useful upper bounds for the numerical errors, independent of the heuristically chosen enrichment functions. Two sets of numerical experiments are presented. First, the error estimate is shown to capture the decrease in the error as the number of enrichment functions is increased or the time discretization refined. Second, the estimate is used to predict the behaviour of the error where no exact solution is available. It also reflects the errors incurred in the poorly conditioned systems typically encountered in generalised finite element methods. Finally we study local error indicators in individual time steps and elements of the mesh. This creates a basis towards the adaptive selection and refinement of the enrichment functions.

REFERENCES

[1] Muhammad Iqbal, Heiko Gimperlein, M. Shadi Mohamed and Omar Laghrouche, *An a posteriori error estimate for the generalized finite element method for transient heat diffusion problems,* International Journal for Numerical Methods in Engineering 110 (2017), 1103-1118.