

ENRICHED FINITE ELEMENT METHOD FOR TIME-DEPENDENT CONDUCTION-RADIATION PROBLEMS IN GLASS

M.S. Mohamed

School of Engineering & Computing Sciences, Durham University, South Rd, Durham DH1 3LE, UK,
m.s.mohamed@durham.ac.uk

M. Seaid

School of Engineering & Computing Sciences, Durham University, South Rd, Durham DH1 3LE, UK,
m.seaid@durham.ac.uk

J. Trevelyan

School of Engineering & Computing Sciences, Durham University, South Rd, Durham DH1 3LE, UK,
jon.trevelyan@durham.ac.uk

O. Laghrouche

School of the Built Environment, Heriot-Watt University, WA 2.28A, Edinburgh EH14 4AS, UK,
o.laghrouche@hw.ac.uk

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ABSTRACT

Time-independent hybrid enrichment for finite element solution of transient radiative heat transfer problems in glass is presented. The radiation effects are accounted for in the heat equation using a stationary diffusion approximation to the radiation. To integrate the equations in time we consider a semi-implicit time stepping scheme in the finite element framework. As enrichment functions in the partition-of-unity finite element method we propose hyperbolic enrichment functions based on an approximation of the boundary layer. The performance of the method is illustrated using test examples of radiative heat transfer in different enclosures. The obtained results are also compared to conventional piecewise polynomial finite element approximations.

It is illustrated that this approach can be more efficient than using h adaptivity in increasing the accuracy of the finite element method near the boundary walls. The performance of the proposed partition-of-unity method is analyzed on several test examples of transient conduction-radiation in glass. The aim of such a method compared to the classical finite element method is to solve practical applications in transient conduction-radiation problems efficiently and with a high level of accuracy. The use of a family of spatial enrichment functions allows variations in time to be automatically considered, and there is no need in this formulation to introduce time-dependent enrichment functions.