

AUTOMATED GENERATION OF CODE FOR MODELLING DISCONTINUITIES

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Key Words: *Automated modelling, partition of unity, multiphysics problems.*

ABSTRACT

Significant advances have been made over the past 10 years for the computational modelling of localised evolving discontinuities in continuum problems. Using finite element methods, developing discontinuities which are not explicitly built into the underlying mesh can now be modelled. An issue with such methods is that their implementation can be time consuming and tedious, particularly for problems which involve various combinations of continuous and discontinuous fields. We present here extensions of developments in automated computer code generation for generic variational forms to the modelling of discontinuities. The goal is to convert input which reassembles mathematical notation for variational forms, including discontinuous functions, into low-level, optimised computer code automatically. Problems which involve combinations of different fields, possibly of different orders, which are continuous and discontinuous can then be addressed rapidly and efficiently. Also, the ‘mathematical’ input is detached from the underlying implementation details and permits the trivial adoption of future developments for representing discontinuities. As a demonstration of the approach we present several problems, including discontinuities in incompressible elastic media and fluid flow through deforming porous media with discontinuities.