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

Advances in Modeling Voids in Staggered Multi-Material Arbitrary Lagrangian-Eulerian Hydrodynamics

Matej Klima[1], Mikhail Shashkov[2] and Andrew Barlow[3]

[1] Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Trojanova 13, Praha 2, 120 00, Czech Republic, klimamat@fjfi.cvut.cz
[2] XCP-4 Group, Los Alamos National Laboratory, Los Alamos, NM 87545, USA, shashkov@lanl.gov
[3] Computational Physics Group, AWE Aldermaston, Reading, Berkshire, RG7 4PR, UK, Andy.Barlow@awe.co.uk

Keywords: *Lagrangian hydrodynamics; multi-material cells; interface-aware sub-scale closure models; void closure; void opening.*

Voids are a representation of ideal vacuum in multi-material environments. They are defined so that they always have zero density, pressure and internal energy. Unlike physical materials, void regions in the simulation can close completely or open in places where they previously did not exist. Void closing and opening capabilities are useful for modeling impact problems, contact surfaces, collapsing cavities and vacuum environments in general, improving robustness and computational expense. This approach offers less limitations than using multiple meshes coupled with sliding lines.

We present our multi-material framework for modeling fluid – void interactions in the context of indirect Arbitrary Lagrangian-Eulerian (ALE) simulations [1, 2]. It is based on the interface-aware sub-scale dynamics (IA-SSD) concept [3]. In such model, all materials that share a common boundary interact within a computational cell in a pair-wise fashion, utilizing the information about the geometry of the material interfaces. The results of testing problems and proposed applications are presented for one- and two-dimensional multi-material ALE calculations.

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