Local slide line merging capability

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ABSTRACT

Slide lines [1, 2] allow material interfaces to be accurately represented where frictional forces are applied, different shock speeds in materials create thin shear layers, or mesh tangling is likely to occur. Allowing the interfaces to move, or slide, relative to each other with pure Lagrangian or minimal ALE motion avoids the internal elements of the mesh becoming distorted in each material, and also allows for additional physics to control the extent of the slide movement. Where the slide interface becomes distorted, for example due to high local curvature on the slide line, robustness issues may be introduced in ensuring correct node movement along the slide line. In this case, to allow the slide line node movement to be compatible with the local mesh movement, it may be beneficial to merge or partially zip the slide line and ALE the interface instead.

Development of a capability to merge slide lines on spatially decomposed meshes is presented. This process involves allowing slipped slide line nodes to move along the slide line to the co-ordinates of their corresponding master slide line nodes via an iterated local remap once the merge condition has been triggered. Once merged, mesh connectivity is updated, with ghost data created if the merged node lies on a processor boundary. The merged interface may then evolve due to multimaterial ALE mesh motion. The method allows slide lines to be merged completely, or for slide nodes to be gradually zipped once the local merge condition has been met for each node. Examples are shown demonstrating the performance of the method.

References

[1] M. Wilkins, "Calculations of elastic-plastic flow", *Method. Comput. Phys.*, 3, pp. 211262, 1964.

[2] A.J. Barlow and J. Whittle, "Mesh adaptivity and material interface algorithms", *Chem. Phys. Reports*, 19(2), pp. 233258, 2000.