An implicit meshless Material Point Method algorithm

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ABSTRACT

In the present paper an implicit meshless MPM algorithm is presented.

Traditional MPM algorithms use a fixed Eulerian background grid, where the finite element calculation is performed, and a set of moving Lagrangian material points to store the historical variables throughout the calculation.

The meshless MPM algorithm presented in this work represents the application of the MPM idea to the case in which both the nodes and the material points are considered as Lagrangian. Differently from the grid-based algorithms, the position of the nodes is allowed to evolve through the whole simulation, so that the nodes preserve their history and can be used to store historical variables. The meshless MPM algorithm represents a very natural generalization of a traditional grid-based one. The idea is that each material point behaves as a fully-fledged updated Lagrangian element, with a preassigned integration weight and position, chosen such that the sum of all the integration weights equals the volume of the domain of interest [1].

The practical implication of using Lagrangian nodes is that it is never needed to project quantities from the material points to the nodes. The price paid for such simplification is, however, that the shape functions need to be considered in a purely meshfree fashion so to handle arbitrary variation in the relative position of the nodes.

The meshless MPM code presented is implemented within the Kratos Multiphysics framework [2] and applied for the resolution of some typical numerical examples to assess the features of such technique.

REFERENCES

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