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Parallel High Performance Simulation for the Stabilized Optimal Transportation Meshfree Method

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Meshfree methods provide a flexible approach to study fusion, cutting processes and free surface flows comparing to meshbased schemes like the Finite Element Method having a fixed connectivity between the nodes.

In this paper, parallel implementation of the Stabilized Optimal Transportation Meshfree (OTM) method is discussed [2]. In the original OTM method an additional algorithm for a nodal rearrangement is required to ensure stable computation. But, in the Stabilized OTM method the origin for the unphysical movement of the original version is identified and diminished by using stabilization. The final solution scheme ensures an improved accuracy and avoids additional computational efforts. The search algorithm which is being used to compute the shape functions, are computational intensive leading to large computational time [2]. Parallelisation is implemented using Message Passing Interface (MPI) with an objective to reduce the computational time. The initial static domain decomposition is done by distribution of the material points. The challenges are involved in developing the communication architecture for implementing search algorithm and stabilization scheme, identification of shared nodes among subdomains in different cores and transfer of nodal and material points among the cores based on their updated positions. Parallel performance analysis, such as the speed up factor on multiple cores and almost equal load balancing across the cores is investigated in several examples. The results are compared with the performance on a single core.

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