# Advanced Dynamic X-Mesh Interface Modeling for Yield-stress fluid application

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**Abstract**

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Precise representation of interfaces is crucial for improving the accuracy of numerical simulations in fluid and solid mechanics. Within the scope of the X-Mesh project, this study aims to develop advanced dynamic and automatic meshing method for modeling complex interfaces (1), here with a specific focus on yield stress fluids as the application.

The X-Mesh framework explores two complementary approaches. The first approach, well adapted for fluid flows (2), involves placing mesh nodes directly on the fluid interface to enhance precision in transitional zones, such as those between solid and shear flow phases for the yield stress application. The second approach presented here, particularly tailored for solid mechanics problem, relies on an adaptive redistribution of nodes across the entire domain and based on minimization of a specific energy. Concerning the computational method, the numerical optimizer plays a critical role and must be well-suited to the specific problem. These both aspects will be detailed. Results show that node redistribution notably improves the quality of numerical solutions and enhances simulation convergence, particularly in regions with significant variations in physical fields.

This research advances mesh optimization techniques can be adapted to others multiphysics interfaces, offering a robust solution to reduce simulation errors, relevant for both industrial and academic applications.

**Keywords** : adaptive meshing, complex interfaces, fluid mechanics, multi-physics simulations.

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