Analysis of Elasto-Plastic Deformation Using Multi-Scale Meshfree Method

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A multi-scale meshfree method has been presented for the efficient analysis of elasto-plastic problems. Through the scale decomposition, problem is decomposed into fine-scale and coarse-scale problems[1]. Each scale variable is approximated using meshfree method. Meshfree approximation has good properties about adaptivity. As a method of increasing resolution, partition of unity based extrinsic enrichment is used[2]. Each scale problem is solved iteratively. Iteration procedure is indispensable for the elasto-plastic deformation analysis. Therefore this kind of solution procedure is adequate to elasto-plastic deformation problem.
The proposed method is applied to the Prandtl's punch test and shear band problem. In the analysis of Prandtl's punch test problem, the proposed method shows robustness to the locking. On the other hand, FEM and conventional meshfree method exhibit locking response. In the shear band problem, the proposed method shows concentrated plastic region and can capture shear band. Also it gives insensitive results to nodal distribution than those of meshfree method.
The proposed multi-scale meshfree method is expected for the analysis of local phenomenon problem other than plastic problem. Studies on the decomposition algorithm and solution procedures of such local phenomenon problem will be valuable in future.

References

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