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A combined approach of the MLPG method and nonlinear programming for lower-bound limit analysis

S. S. Chen[1], Y. H. Liu[1,2], Z. Z. Cen[1]

Summary

In most engineering applications, solutions derived from the lower-bound theorem of plastic limit analysis are particularly valuable because they provide a safe estimate of the load that will cause plastic collapse. A solution procedure based on the meshless local Petrov-Galerkin (MLPG) method is proposed for lower-bound limit analysis. This is the first work for lower-bound limit analysis by this meshless local weak form method. In the construction of trial functions, the natural neighbour interpolation (NNI) is employed to simplify the treatment of the essential boundary conditions. The discretized limit analysis problem is solved numerically with the reduced-basis technique. The self-equilibrium stress field is constructed by a linear combination of several self-equilibrium stress basis vectors, which can be computed by performing an equilibrium iteration procedure during elasto-plastic incremental analysis. The non-linear programming sub-problems are solved directly by the Complex method and the limit load multiplier converges monotonically to the lower-bound of real solution. Several numerical examples are given to verify the accuracy and reliability of the proposed method for lower-bound limit analysis.

[1]Department of Engineering Mechanics, Tsinghua University, Beijing 100084, P. R. China.

[2]Corresponding author. Tel: +86-10-62773751; fax: +86-10-62781824; Email: yhliu@mail.tsinghua.edu.cn (Y. H. Liu)