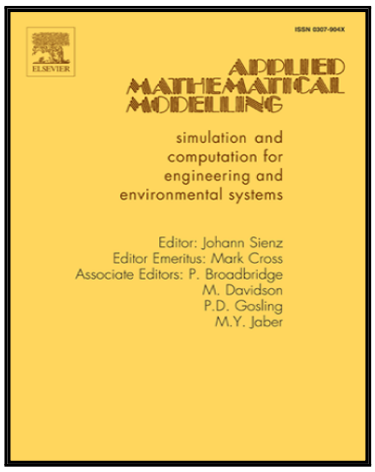

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Limit state analysis of reinforced concrete slabs using an integrated radial basis function based mesh-free method

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Abstract

Limit analysis, a general and powerful method to predict the collapse load of reinforced concrete slabs, combines the limit theorems of classical plasticity with numerical methods, and results in an optimization problem. The number of variables in the corresponding optimization problem depends on the number of degrees of freedom used per node. In this paper, a rotation-free meshfree method based on integrated radial basis functions (iRBF) is developed. There is no rotational degree of freedom involved in the approximation, and hence the size of the resultant optimization problem is kept to a minimum. Moreover, the iRBF based shape functions hold the Kronecker delta property, ensuring that there is no need for any special treatment when enforcing essential boundary conditions. The obtained discrete kinematic formulation is handled using available highly efficient solvers. Various Nielsen's reinforced concrete slabs of arbitrary geometries are examined, showing that the proposed numerical procedure is capable of providing accurate collapse load multipliers and automatically identifying yield-patterns in terms of plastic dissipation distribution.

Key words: Limit analysis; yield design; integrated radial basis function; mesh-free method; second order cone programming

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