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HOURGLASS CONTROL IN FINITE ELEMENT METHOD FOR LIMIT ANALYSIS

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Limit analysis deal with direct computation of ultimate load producing collapse of structure. fZouain et al.[1] proposed finite element method for limit analysis based on lower bound theorem. Their proposed method has a strong tendency to raise locking problem especially in plane stress problems. Application of triangular or tetrahedron mesh to their method can give value of collapse load greater than correct value. On the other hand, usage of quadrilateral or hexahedron mesh can cause hourglass mode (zero energy mode). Some researchers try to solve the mesh problem by means of adaptive approach, however, the adaptive mesh refinement increases degree of freedom and requires much computational cost.

In order to calculate collapse load correctly with less computational cost, we apply Pian-Sumihara element to their method. In two dimensional analysis, Pian-Sumihara element express stress based on the basis vector of natural coordinates in a quadrilateral element using 5 independent variables, which prevents hourglass mode.

To verify the validity of our proposed method, some simple two or three dimensional problems are solved. The results are compared to the analytical solutions and the result on other papers and are in good agreement with them.

REFERENCES

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