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A new direct elimination algorithm for quasi-static and dynamic contact problems

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ABSTRACT

In this paper a new method for the analysis of contact problems based on a direct elimination of restricted displacements is presented. The method has been implemented for three-dimensional elements in cases of sticking and frictionless.

For sticking contacts, the method is based on expressing the displacements of the slave nodes as a function of the displacements of the master nodes, allowing the direct elimination of constrained degrees of freedom. This leads to a series of changes of the tangent stiffness matrix and residual vector. The transformed tangent stiffness matrix keeps its symmetry and positive definite properties.

For frictionless contact an extension of the previous method is presented. The relative displacements of the slave nodes are expressed as a function of the natural coordinates of the master elements. The changes in the tangent stiffness matrix and residual vector reflecting these restrictions are presented. As in the previous case, the transformed tangent stiffness matrix keeps its symmetry and positive definite properties.

An extension of the presented model for energy conserving dynamic problems is also presented.

Finally a set of suitable examples in order to validate the performance of the proposed method is presented

REFERENCES

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