Iterative Solver For Solving Large-scale Frictional Contact Problems

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ABSTRACT

Solving friction contact problems is of great importance in many engineering applications. For these applications, the precision and the optimization of the calculation time are imperative but often contradictory. Industrial problems generally involve complex and three-dimensional geometries composed of materials with non-linear behavior. Consequently, using the finite element method, they lead large-scale non linear discrete problems and, after linearization, to algebraic systems of several thousand or even millions of unknowns and ultimately to calculations needing iterative methods. This implies that the frequently used methods, the penalization and the augmented Lagrangian, are to be banned because of their negative effect on the condition number of the underlying discrete systems and thus on the convergence of iterative methods. We will propose an efficient iterative approach to solve the problems of contact associated with industrial applications: a resolution allowing to have precise numerical results in an acceptable computation time.

This approach will be based on the Lagrange multiplier method and a method of solving the associated linear system that is not quite standard. The latter is part of an iterative, multi-level process that represents the main contribution. We will present the adopted strategy that is different from that of the literature for the resolution of saddle-type problems and will make a complete study of it. To validate our approach, we will study academic numerical examples of classical contact problems. We will also present some large-scale industrial problems in order to illustrate the efficiency, accuracy and computation performance of the method developed.

REFERENCES

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