A Computional Model for Elastic-plastic Dynamic Contact

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ABSTRACT

The dynamic contact problem has received considerable attention in recent years. From the physical point of view, there is a wide field upon which the dynamic contact problem could be applied, such as in nuclear power plants, automotive industry, aircraft industry and defense industry.

The other side of interest, is the mathematical one, where the highly non-linear complexities arise, such as the change of kinematics boundary conditions, the large deformations in addition to material nonlinearities. To deal with a real structure, the structural damping should be accounted for in addition to the friction of joints. If these effects are considered in the solution of the problem, it will become cumbersome.

Plastic flow is an important aspect to be considered, especially in the dynamic contact problems, since in spite of elastic loading, plastic flow may be reached in the contact zone due to high stresses in this region.

Considerations of the above points have led to the objective of the present work which has two folds. The first is to develop a computational model to simulate the dynamic contact of deformable bodies having the visco-

elastic-plastic material behaviour. The proposed model is an incremental variational one, based on a previously developed incremental convex programming procedure. Finite element method is adopted as a discretization engine, in addition Ralyiegh method is used to represent the structural damping. Prandtl-Reuss constitutive relations in conjunction of von-Mises criterion have been used to determine plastic flow. The second is to investigate the effect of impact load and study the relevant physical aspects, for many problems of different natures. Parametric studies are worked out to investigate the effects of many crucial characteristics.