

NUMERICAL SIMULATION OF 3D IMPACT PROBLEM

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Key Words: *Contact mechanics, dynamic, impact, elastoplasticity.*

In this work 3D simulations of impact problems in solid mechanics are presented. The numerical examples are simulated using a personal program developed by Bandeira, called CMAP (Contact Mechanics Analysis Program), that consists to solve impact problems using the implicit methods, [1], [2], [3], [4], [5], [6], [7].

The bodies in contact undergo finite deformation within an elastoplastic range, [8], [9]. The augmented Lagrangian method is used to solve the contact problems with friction, [10], [11], [9], [12], [13]. For the contact formulation within the finite element method, the matrix formulation for a node-to-surface element consisting of a master surface with four nodes and a contacting node is derived. Here, the discretised contact surfaces are not smooth, i.e. there is no continuity of the normal vector between the adjacent surfaces. At the edge between the surfaces the normal is not uniquely defined, that needs a special algorithmic treatment. These contact formulations considers the possible sliding of slave node from one surface to the adjacent one.

The purpose of this paper is to present numerical examples of impact problems using the algorithms of contact mechanics, non-linear dynamics and elastoplasticity based on an associated von Mises yield function formulated in principal axes, [14]. The plasticity formulation is derived based on exact linearization. The nonlinear dynamic theories is applied to solve impact problems such that can produce stable solutions in nonlinear brick dynamics by applying standard time integration methods, such as the Newmark method and Generalized α method, [15], [16], [17], [18]. Acceptable time step sizes or modified time integration schemes is necessary in order to produce accurate and computationally efficient results. Several numerical examples of impact problems in elastoplastic range are presented to show the algorithm ability. All numerical examples are modelled by using brick elements.

The numerical simulations are modelled in the personal program CMAP (implicit methods). Some discussions are making about the implicit methods to solve impact problems.

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