NUMERICAL ANALYSIS OF FRICTIONLESS CONTACT BETWEEN 3 – D BEAMS WITH CIRCULAR CROSS-SECTION

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ABSTRACT

The main purpose of computational contact mechanics is to provide numerical tools to properly describe physical behaviour of bodies coming in contact. Beam-to-beam contact is a special case in this field. There are several related contributions, e.g. [2], [3], [4], [5].

In this paper numerical analysis of contact between three-dimensional elastic beams with deformations at the contact zone is carried out. The results of beam-to-beam contact analysis are compared with the ones for full 3D problem solved in the Abaqus/Enviroment. The aim of the conducted numerical simulations was to select a most appropriate 3D model and treating it as reference to verify if the beam-to-beam model is able to describe correctly the contact mechanics between beams of circular cross-section.

In the beam-to-beam approach the deformations at the contact zone were modelled using the classical Hertzian contact between two elastic cylinders are introduced. A resulting physical law was introduced in the contact interface to replace the approach with the modified gap function presented in [2]. The curves representing the beam axes were defined using Hermite's polynomials. The appropriate kinematic variables for contact were discretised using the finite element method methodology. The beams were modelled using elastic co-rotational finite elements proposed by Crisfield [1].

In the case of the Abaqus/CEA analyses the 3D solid models of beams were considered. The elastic material was assumed. All calculations were performed using the Newton-Raphson procedure. The verification of the model comprised the following aspects: the beams arrangement, the mesh size and the type of finite element. Two verification criteria were considered, namely the magnitude of the contact forces and the size of the deformations of the beams cross section in the vicinity of the contact points.

Numerical examples with results and conclusions will be presented at the conference.

References