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Combined multibody dynamics, finite elements and CAD methodologies for the design of road structures

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ABSTRACT

Road accidents are one of the major concerns in the world society nowadays, particularly the pedestrian and motorcycle accidents that represent a great number of fatalities in Europe. To develop accurate computational models for the design of road hardware such as pedestrian-friendly fronts for the vehicles or guardrails protection for motorcyclists the deformation of such structures must be taken into account, because the contact surfaces changes during the impact and this affect the biomechanical criteria of the road users.
The interest of such methodologies is especially for vulnerable road users, where direct contact between the road users and the structures occurs. Several works have been devoted to the develop of structures for motorcyclists [1, 2] or pedestrian accidents [3], however the use of biomechanical criteria in the design of the structures is not yet fully understood.
The design methodology presented in this work, involves the development of the structures using a 3D CAD system, the geometry are migrated to the finite elements program Ansys in order to develop the meshes and the finally the meshes are imported to the multibody dynamics Madymo software in order to simulate the impact between the structures and a human body multibody model. With these methodology the deformation of the structures are taken into account and also biomechanical criteria's such as HIC (Head Injury Criteria) are used for the design of the structures
The interaction between the multibody and finite elements data represents one of the major problems difficulties for the development of accurate models. These aspect related especially with the contact-impact model are detailed discussed as also all the aspect that affects the response during the impact situation.
Some examples to illustrate the methodologies developed including the development of pedestrian-friendly fronts of vehicles and motorcyclist user-friendly barriers are presented.

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