DEVELOPMENT AND VALIDATION OF A BIOMECHANICAL FE MODEL (HUBYX) OF THE HUMAN SYSTEM FOR HIGH SPEED DYNAMIC SIMULATION. APPLICATION FOR THE BLAST

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Finite element analysis is frequently used in several fields such as automotive simulations or biomechanics. These numerical simulations can lead to the comprehension of mechanical behaviour of complex structures. The development of computer science brought the possibility to develop realistic computational models with a “biofidelic” behaviour, avoiding the difficulties and costs of experimental tests. In the context of numerical biomechanics, lots of FE models have been developed, allowing the investigation of the behaviour of the human body submitted to heavy damage such ballistic impact and blast effect where the full body are frequently injured. The understanding of the behaviour of this complex system is of extreme importance. In order to explore the dynamic response of the human system to high speed dynamic loading, a finite element model of the human system has, therefore, been developed including the skeleton, the viscera, the upper and lower limbs

The FE model is based on a 3D reconstruction of CT scan slices of anonymous patients. Material properties of the literature have been implemented in the model. The 50th percentile model has been validated against experimental data available in the literature, in terms of deflexion, force, whose response are reasonably within experimental corridors. To the standards experimental tests often used to validate models in the context of automotive industry, the developed model is also validated against experimental blast tests. The HUBYX model reproduces the experimental response reasonably compared to EUROSID and HYBRIDIII, and HUBYX increase capability to check more points on the body. Coupling the new developed model with a numerical FE seat, can lead to injury criteria and tolerance limits of human, providing important data for the design of efficient protective systems.