UPPER HUMAN BODY PARTS RESPONSE DURING HEAD-ON AND REAR CAR COLLISION

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This paper presents modelling process and numerical analysis of two-dimensional dynamical model. The aim of these modelling researches is creation of the model which enables human upper body motion analysis in a situation corresponding to real head-on and rear collision with simultaneous analysis of internal physiological phenomena. The model consists of head, seven cervical vertebrae and trunk treated as articulated rigid bodies. Soft tissue interactions are represented by spring-dumper elements with assumed stiffness and dumping acting on characteristic points. The model was used to numerical analysis under dynamical loading corresponding to real accidents.

Key words: *modelling in biomechanics, human spine, numerical simulation*

1. Introduction

The human cervical spine plays the leading role in the organism as a motion organ, spinal cord protection and head support. As far as the biomechanics is concerned the enumerated tasks of human spine are very different. The spine is the most complicated in shape and tissue characteristics element of the bone-muscle system, which is connected with its difficult role as a good spinal cord protector and a motion organ.

Injuries of human head and cervical spine and their consequences are constant inspiration for scientists specializing in interdisciplinary field. The aim of these activities is better protection of human body. At present there are no medical and technical methods, which allow conducting diagnosis of internal physiological phenomena during daily routine. The injury mechanisms are the most difficult for scientist to recognize. The main source of knowledge about them are mathematical modelling and experimental researches.

The experiments are carried out to identify and verify mathematical models created with the use of professional or author programs. Modelling researches concerning biological systems demand the application of serious simplifications of tissue characteristics. The models are created for analysis of the particular cases.

The aim of these modelling researches is creation of the model, which enables human upper body motion analysis in a situation corresponding to real head-on and rear collision with simultaneous analysis of internal physiological phenomena. It has been assumed that during head-on and rear car collisions the human body moves in middle-saggital plane.

The model was created with the use of Working Model system as an open kinematical chain with 12 degrees of freedom. The model was used to numerical analysis under dy-

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