DEFORMABLE MODEL OF MALE ABDOMEN

Luděk Hynčík, Vít Nováček*, Ivan Krakovský**, Václav Báča, David Kachlík†

Biomechanical simulation activities are seen to undergo considerable growth in volume and scope. More complex and more complete models are now being generated. Biomechanical simulations are considered and extended well into the fields of transport vehicle occupant safety, biomedicine and virtual surgery, ergonomics and into the fields of leisure and sports article manufacture.

In all fields, the problems of human body geometry acquisition, geometry discretization in space, material identification and calibration, joint and organ representation, numerical model validation and computational comfort and efficiency must be addressed and solved likewise. This creates a strong synergy between the biomechanical applications in each of the mentioned fields.

The goal of this study is to develop a biomechanical deformable male abdomen model in a finite element code which will be useful for industrial applications. The proposed work is a part of the global project covered by the ESI Group International, SA. company and an extension of a Ph.D. thesis [7]. It enriches already existing biomechanical human model under the PAM-SAFE™ software environment by model of abdominal organs and tissues. Visco-elastic material properties of chosen tissues are measured on cadavers.

Key words: *biomechanics, human body, deformable, experiment, lateral validation*

1. Introduction

The deformable model of the male abdomen presented in the paper is the extension of the multi-body human model [8]. The multi-body human model being developed for couple years is a rigid body based jointed model. The human (we have both male and female and we are able to create various specimen of human population thanks to our scaling algorithm) geometry is divided into rigid bodies with attached masses and inertias connected by kinematic joints. The geometry is based either on the ViewPoint data [11] or anatomical books [4]. Meshing was done by the *HYPERMESH*®package.

2. Deformable access

Since we want to focus just on abdomen, we should delimit the abdominal part from the rest of the human body. Figure 1 delimits the deformable part of the presented human model. Those planes are anatomical planes dividing the abdomen from the rest of the human body.

* Ing. L. Hynčík, Ph.D., Ing. V. Nováček, New Technologies Research Center in the Westbohemian Region, University of West Bohemia, Univerzitní 22, 306 14 Plzeň

** RNDr. I. Krakovský, CSc., Department of Macromolecular Physics, Faculty of Mathematics and Physics of the Charles University, Ke Karlovu 3, 121 16 Praha 2

† MUDr. V. Báča, MUDr. D. Kachlík, 3^{rd} Medical Faculty of the Charles University, Ruská 87, 100 00 Praha 10