VIRTUAL ANTHROPOMETRIC HUMAN MODELS FOR SAFETY

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INTRODUCTION

Virtual human models become a powerful tool for design of safe and human-friendly vehicles by the numerical way. Hence correct anthropometric and biofidelic computational models are necessary to be developed.

METHODS

Humans are not uniform, everyone is an original being from the anthropometrical point of view and concerning mechanical characteristics. However, the development of a particular human body model for all of us is not possible. The idea is to have one (or couple of) standard model(s) as a base that can be modified to create additional models.

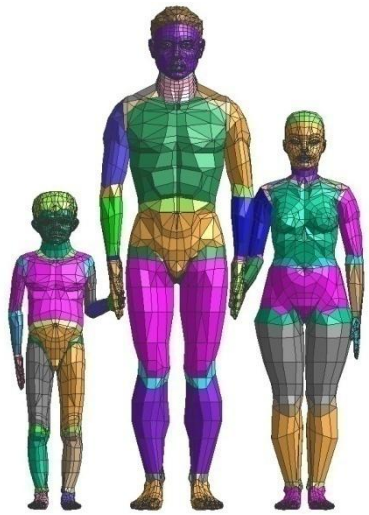

Figure 1: The ROBBY family (from left: the 6 years old child BOBBY6, ROBBY2 50%-tile male and ROBINA 5%-tile female).

The basic ROBBY family models [3] developed on the PAM computational platform are used as a reference set (see Fig. 1). The models consist of rigid bodies separated into segments connected by biomechanical joints and active muscles [6]. A large set of statistical data based on around 13.000 specimens previously measured [1] has been used. The data concerns major anthropometric dimensions for male, female and children within the population of the Czech Republic between 3 and 55 years.

The anthropometric measures defined by the experimental data have been measured also on the reference models for each segment (Table 1). The measures are then used to compute the relation between the segments of the reference model and the model of desired age in three dimensions. Based on this relation, each segment of the reference model is scaled onto the dimensions of the desired model. The inertial properties of the scaled model are also scaled based on the definition of inertia matrix and volume change considering unique density distribution for each segment [2].

RESULTS AND DISCUSSION

The first results [2] have been extended by younger children under 6 years. A Python [5] based tool for automatic scaling has been created. To validate the scaled models, a standard sled test situation has been simulated. For chosen models, the results have been compared to the experimental data.

CONCLUSIONS

A scaling tool for human models has been developed. The tool creates automatically virtual human ARB computational models in range between 3 and 55 years based on the ROBBY family models implemented on the PAM platform. The chosen models have been validated. The models are used to analyze the human body response under impact.

ACKNOWLEDGEMENTS

The work is supported by the project CG911-044-150 of the Czech Ministry of Transport and by the John H. and Amy Bowles Lawrence Foundation.

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Table 1: Anthropometric measures used to scale segments in three major dimensions.

Depth	Width	Height (length)
Head maximal circumference	Chest transversal diameter	Body stature and position of points:
Chest sagittal diameter	Bicristal, bispinal	Suprasternal, suprailiacal, iliospinal
Thigh gluteal circumference	Distal humeral epiphysis, wrist, hand	Symphysion, acromiale, radiale
Foot length	Distal femoral epiphysis, ankle, foot	Stylion and dactylion