Mass-inertial Parameters of the Human Thigh Based on Data for Bulgarian Males: Three-dimensional Mathematical Model Study

Gergana S. Nikolova

Institute of Mechanics, Bulgarian Academy of Sciences, Department of Biomechanics, Acad., G. Bonchev Str., Building 4, Sofia 1113, Bulgaria

gergana1973@gmail.com

The estimation of body segment parameters is important for human motion analysis and many biomechanical activities. For studying these a precise modeling of the individual segments of the body is necessary. The aim of this work is to improve the geometric modeling of the human thigh of the Bulgarian males [1], taking into account that the segment is dissect from the torso with a plane passing through the anterior superior iliac spine at an angle of 37° degrees to the sagittal plane. In our previous study the thigh was modeled as a frustum of cone. In the current study the thigh is modeled with geometric body being a combination of a frustum of circular cone on top of which is placed a part of cylinder cut with a plane making angle of 53° with respect to its base. This second part extends from anthropometric points omphalion - iliospinale. Modeling of the body segments by means of simple geometrical bodies enforces a serious approximation of their shape and, therefore, of their volume and related characteristics as mass and moments of inertia. Hence, adjustment of the measured geometrical parameters that would produce the best approximation of the body segment mass characteristics is highly desirable. This can be done by using the regression mass equations derived in Zatsiorsky and Seluyanov and Shan and Bohn. Yet, by doing so we avoid deviations of the adjusted parameters from the measured values, larger than 10%. We derive analytically and estimate numerically the volume, mass, the position of the center of mass and moments of inertia of the thigh and compare these results with the ones available from the literature for other Caucasian.

References

[1] Nikolova G., Toshev Y., *Estimation of male and female body segment parameters of the Bulgarian population using a 16-segmental mathematical model*, Journal of Biomechanics **40**, 3700–3707, 2007.