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

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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 dis-
sect 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 ex-
tends 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 approxima-
tion 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 mathemat-