Literature Review of Body Inertial Parameters

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1. Body segment mass, radius and radius of gyration proportions of children
   1. General Information
      1. Date: 1985
      2. Author: R.K. Jensen
      3. File name: **jensen1986massprop**, jensen1986COG
   2. Model Information
      1. Segmentation used: Head, Torso, Upper arm, Forearm, Hand, Thigh, Calf, Foot
      2. Subjects: Male children age 4-15
      3. Data
         1. **jensen1986massprop**: percentage of total body weight that each limb weighs
         2. ensen1986COG: proportions of center of gravity of each limb
      4. Other notes:
         1. Regression given based on age
         2. **jensen1986massprop** used in ICRA submission
2. **Changes in segment inertia proportions between 4 and 20 years**
   1. General Information
      1. Date: 1989
      2. Author: R.K. Jensen
      3. File name: jensen1989changesininertia, jensen1989segmentpicture
   2. Model Information
      1. Segmentation used: Head, Upper Torso, Lower Torso, Upper arm, Forearm, Hand, Thigh, Calf, Foot
         1. Also has Forearm+hand, Calf+Foot
      2. Subjects: Male children age 5-20
      3. Data
         1. jensen1989changesininertia: percentage of total body weight that each limb weighs
         2. jensen1989segmentpicture: picture of segmentation lines
      4. Other notes:
         1. **This is the study used in the ICRA submission**
         2. Regression given based on age
3. **Anthropometric Relationships of body and body segment moments of inertia**
   1. General Information
      1. Date: 1980
      2. Author: J.T. McConville, et al
      3. File name: mcconville1980Anthro
   2. Model Information
      1. Segmentation used: Head, Neck, Top Torso, Mid Torso, Low Torso, upper arm, lower arm, hand, thigh, calf, foot,
         1. Also contains information for: flap, thigh-flap, forearm+hand
      2. Properties Measured: CoM, MoI, length, weight
      3. Methods for collection: stereophotographic
      4. Subjects: Male subjects
      5. Data:
         1. Segmentation on 16-19
         2. Length data on 32
         3. MoI and CoM data on 36
      6. Other notes:
         1. Page 29: comparison of density of body parts
         2. Contains regression eqns for Volume, and MoI based on stature and weight
         3. Summarization of MoI around x axis results can be found in the file **mcconville1980AnthroXMOI**
         4. The study notes that due to the limited sample population (airforce personnel) they could not get measurements for all weight/height combinations. That is to say, these results are representative only for those with body types similar to those in the military.
4. **Segment inertial properties of Chinese adults determined from magnetic resonance imaging**
   1. General Information
      1. Date: 2000
      2. Author: Cheng-Kung Cheng, et. al
      3. File name: cheng2000MRI
   2. Model Information
      1. Segmentation used: Head + neck, Trunk, Upper arm, forearm, hand, thigh, shank, foot
      2. Properties Measured: CoM, MoI, mass proportions,
      3. Subjects: Female and male chinese subjects
      4. Methods for collection: MRI
      5. Other notes:
         1. Results were calculating by integrating over the empirical density of body parts using an MRI to estimate density and volume.
5. Investigation of Inertial Properties of the Human Body – Aerospace Medical Research Laboratory
   1. General Information
      1. Date: March 1975
      2. Author: R.F. Chandler, C.E. Clauser, J.T. McConville, H. M. Reynolds, and J.W. Young
      3. File name: Chandler1975Investigation
   2. Model Information
      1. Segmentation used: 14 segments: Head, Torso, Upper Arm, Forearm, Hand, Thigh, Calf, Foot
      2. Properties Measured: Moments of Inertia, center of mass, mass, and volume
      3. Subjects: 6 male cadavers
      4. Methods for collection: Direct measurement using pendulum
      5. Data location in document:
         1. Segmentation lines: Go to page 51
         2. Axis centering based on landmarks: Go to page 72
         3. List of tables for data on page 9 of pdf. Data starts on 78
      6. Other notes:
         1. Regression equations given for MoI and segment mass based on weight and segment volume
         2. Also compares to theoretical CoM and MoI properties making uniform density and simplified shape assumptions (Page 111).
6. Anthropometry and mass distribution for human analogues, Volume 1: Military Male Aviators
   1. General Information
      1. Date: March 1988
      2. Author: R.G. Armstrong
      3. File name: armstrong1988anthropometry
   2. Model Information
      1. Segmentation used: Head, Neck, Top Torso, Mid Torso, Low Torso, upper arm, lower arm, hand, thigh, calf, foot
      2. Properties Measured: Length Dimensions, Weight, Stature, Segmental mass, MoI
      3. Subjects: Male Aviators
      4. Methods for collection: Anthropometric, stereophotographic, skeletal joint centers obtained by estimation
      5. Data location in document:
         1. Mass and MoI start on 38
         2. Length measurements start on 11
      6. Other notes:
         1. Obtains MoI and CoM by using regression equations from McConville et al. 1980
         2. Gives regression equations based on stature and weight
         3. Subjects were divided into large, small, and average size groups.
7. Anthropometric and mass distribution characteristics of the adult female
   1. General Information
      1. Date: March 1983
      2. Author: J.W. Young
      3. File name: young1983anthropometric
   2. Model Information
      1. Segmentation used: Head, Neck, Torso, upper arm, lower arm, hand, thigh, calf, foot, flap
      2. Properties Measured: CoM, MoI, Volume
      3. Subjects: 46 females
      4. Methods for collection: Anthropometric and stereophotogrammetric.
      5. Data:
         1. Table of Contents page 5
         2. Segmentation on page 20-22
         3. Summary of length statistics on 95
      6. Other notes:
         1. Representative of US female population in the 70s
         2. Regression based on stature and weight
8. Adjustments to McConville et al. and Young et al. body segment inertial parameters
   1. General Information
      1. Date: 2007
      2. Author: R. Dumas, L. Cheze, J.-P. Verriest
      3. File name: dumas2007adjustmentstoMC
   2. Model Information
      1. Segmentation used: Head, upper torso, pelvis (lower torso), upper arm, lower arm, hand, thigh, calf, foot
      2. Properties Measured: CoM, MoI
      3. Subjects: Female and male subjects reported seperately
      4. Methods for collection: stereo - photogrammetric
      5. Other notes:
         1. Results are quite comprehensive but require knowledge of a wealth of landmark information for normalization/ calculating the CoM/MoI for a new person
9. Inertial Properties of the Human Trunk of Males Determined from MRI
   1. General Information
      1. Date: 1994
      2. Author: D.J. Pearsall, J.G. Reid, R. Ross
      3. File name: pearsall1994MRI
   2. Model Information
      1. Segmentation used: Upper torso, mid torso, lower torso
      2. Properties Measured: CoM, MoI, Mass, Density
      3. Subjects: Female and male subjects
      4. Methods for collection: MRI
      5. Other notes:
         1. Just examines torso. In particular looks at differences in volume and mass over different trials.
         2. Results suggest that the main change in volume in the torso is due to gas, and it is highly variable.
10. The Mass and Inertia Characteristics of the Main Segments of the Human Body
    1. General Information
       1. Date: 2007
       2. Author: Zatsiosky
       3. File name: zatsioskyMOI
    2. Model Information
       1. Segmentation used: Head, upper torso, middle torso, pelvis (lower torso), upper arm, lower arm, hand, thigh, calf, foot
       2. Properties Measured: CoM, MoI
       3. Subjects: 40-60 year old male subjects from Russia
       4. Methods for collection: y-scanner
       5. Other notes:
          1. Regression based on weight and stature