

Equations for Computing Body Segment Parameters

Segment Mass ($m_{segment}$):

$$m_{segment} = P_i m_{total}$$

m_{total} = total body mass

Segment Centre of Gravity (x_{cg} , y_{cg}):

$$x_{cg} = x_{proximal} + R_{proximal} (x_{distal} - x_{proximal})$$
$$y_{cg} = y_{proximal} + R_{proximal} (y_{distal} - y_{proximal})$$

$(x_{proximal}, y_{proximal})$ = proximal end of segment
 (x_{distal}, y_{distal}) = distal end of segment

Radius of Gyration about Centre of Gravity (k_{cg}):

$$k_{cg} = K_{cg} L$$

L = segment length

Segment Moment of Inertia about Centre of Gravity (I_{cg}):

$$I_{cg} = m_{segment} k_{cg}^2$$

Segment Moment of Inertia about any Axis (I_{axis}):

$$I_{axis} = I_{cg} + m_{segment} r^2$$

r = distance from centre of gravity to axis

Table of Body Segment Parameters

Proportions used to calculate various body segment parameters*

Segment	P^{**}	K_{cg}^{\dagger}	$R_{proximal}^{\ddagger}$	R_{distal}^{\ddagger}
Hand	0.006	0.297	0.506	0.494
Forearm	0.016	0.303	0.430	0.570
Forearm & hand	0.022	0.468	0.682	0.318
Arm	0.028	0.322	0.436	0.564
Upper extremity	0.050	0.368	0.530	0.470
Foot	0.0145	0.475	0.500	0.500
Leg	0.0465	0.302	0.433	0.567
Leg & foot	0.061	0.416	0.606	0.394
Thigh	0.100	0.323	0.433	0.567
Lower extremity	0.161	0.326	0.447	0.553
Head & neck	0.081	0.495	1.000	0.000
Trunk	0.497	0.500	0.500	0.500
Trunk, head & neck	0.578	0.503	0.660	0.370

))))))))))))))))))))))))))))))

* Values were taken from Winter, D.A. *Biomechanics and Motor Control of Human Movement*, 2nd edition, Toronto: John Wiley & Sons, 1990.

** Segment mass as proportion of total body mass.

† Segment radius of gyration about segment centre of gravity as proportion of segment's length.

‡ Location of centre of gravity from proximal or distal ends of segment as proportion of segment's length.