

Equations for Computing Body Segment Parameters

Segment Mass (m_{segment}):

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

m_{total} = total body mass

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

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

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

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

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

L = segment length

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

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

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

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

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

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* 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

\dagger segment radius of gyration about segment centre of gravity as proportion of segment's length

\ddagger location of centre of gravity from proximal or distal ends of segment as proportion of segment's length