

Electronic Supplementary Materials 1 - Coefficients of the average Force-Length-Activation relationships

This document corresponds to the Online Resource 1 for the article entitled “Modelling Force-Length-Activation relationships of wrist and finger extensor muscles”. Full details of the article are provided below.

Article information

Title

Modelling Force-Length-Activation relationships of wrist and finger extensor muscles

Authors and affiliations

Benjamin GOISLARD DE MONSABERT^{1*}, Hugo HAURAIX¹, Mathieu CAUMES¹, Alexis HERBAUT², Eric BERTON¹, Laurent VIGOUROUX¹

¹ Aix-Marseille University, CNRS, ISM, Marseille, France.

² Department of Movement Sciences, Decathlon SportsLab, Villeneuve d'Ascq, France.

*Corresponding author:

Benjamin GOISLARD DE MONSABERT

benjamin.goislard-de-monsabert@univ-amu.fr

Data

The data provided in the table correspond to the relationships used in the EMG-driven model of the sample population (AVE model). The successive relationships allow to predict muscle force from muscle-tendon unit length and activation level. For further details regarding the determination of those relationships and how to use them, the reader is referred to the corpus and figures of the article.

Relationship between belly length at rest and muscle-tendon-unit length

The table B1 provide the coefficients of the polynomial regression to predict the normalised muscle belly length at rest l_1^m (i.e. L_1^m divided by L_r^m , the muscle reference length in neutral posture) from the normalised muscle-tendon unit length l^{mtu} (i.e. L^{mtu} divided by L_r^{mtu} , the muscle reference length in neutral posture)

Table B1 – Coefficients of the polynomial regression between l_1^m and l^{mtu} .

$$l_1^m = d_2(l^{mtu})^2 + d_1 l^{mtu} + d_0$$

	d2	d1	d0
ECR	25.97	-48.21	23.25
EDC	15.71	-29.60	14.90

Relationships to estimate belly length change fom activation level

The table B2 and B3 provide the coefficients of the non-linear relationships used to estimate the normalised belly length change Δl^m (i.e. ΔL^m divided by L_r^m , the muscle reference length in neutral posture) from activation level a^m . First, a “virtual” normalised force \hat{f}^m is estimated from activation level and Δl^m is then calculated from \hat{f}^m .

Table B2 – Coefficients of the relationship between \hat{f}^m and the activation level a^m .

$$\hat{f}^m(a^m, \alpha) = \alpha_1 \left[\frac{1}{1 + \exp^{-\alpha_2 (a^m - \alpha_3)}} - 0.5 \right] + \alpha_4$$

	α_1	α_2	α_3	α_4
ECR	0.096	0.131	2.014	2.719
EDC	0.334	0.403	1.273	4.467

Table B3 – Coefficients of the relationship between Δl^m and \hat{f}^m .

$$\Delta l^m(\hat{f}^m, \gamma) = \gamma_1 [1 - \exp(-\gamma_2 \hat{f}^m)]$$

	γ_1	γ_2
ECR	0.069	3.614
EDC	0.028	3.717

Parameters describing the Force-Length-Activation relationships

The tables B4-6 provide the coefficients to estimate the parameters describing the Force-Length-Activation relationship as a function of the activation level. i_a is the index of architecture, l_0 is the normalised optimal length (i.e. L_0 divided by L_r^m , the reference belly length) and f_0 is the normalised maximal force (i.e. F_0 divided by F_0^{max} , the maximal isometric force at $a^m=1$).

Table B4 – Coefficients of the polynomial regression between the index of architecture (i_a) and the activation level (a^m)

$$i_a = b_5(a^m)^5 + b_4(a^m)^4 + b_3(a^m)^3 + b_2(a^m)^2 + b_1 a^m + b_0.$$

	b5	b4	b3	b2	b1	b0
ECR	-0.664	2.575	-3.404	1.712	-0.157	0.231
EDC	-0.105	0.308	-0.697	0.792	-0.167	0.173

Table B5 – Coefficients of the polynomial regression between the normalised optimal length (l_0) and the activation level a^m .

$$l_0 = b_3(a^m)^3 + b_2(a^m)^2 + b_1 a^m + b_0$$

	b3	b2	b1	b0
ECR	-0.048	0.196	-0.211	0.971
EDC	-0.050	0.107	-0.083	1.016

Table B6 – Coefficients of the polynomial regression between the normalised maximal force (f_0) and the activation level (a^m).

$$f_0 = b_3(a^m)^3 + b_2(a^m)^2 + b_1 a^m$$

	b3	b2	b1
ECR	-0.029	-0.336	1.361
EDC	-0.528	0.025	1.484