



سیزدهمین کنفرانس مهندسی برق ایران

۲۰-۲۲ اردیبهشت ۱۳۸۴

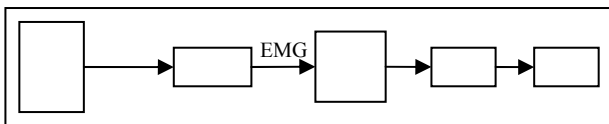


s_mahyad@ee.kntu.ac.ir

Taghirad@kntu.ac.ir

EMG

()



EMG

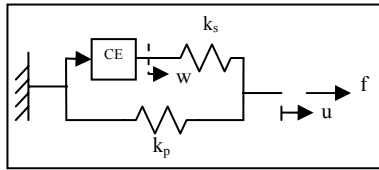
()

EMG

¹ Pattern Recognition

[]

()



(ks)

(CE)

(kp)

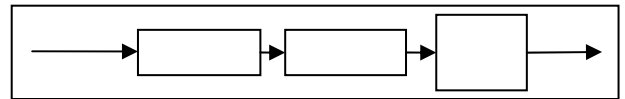
EMG

EMG

EMG

[]

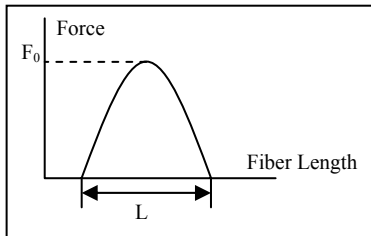
[]



()

F₀

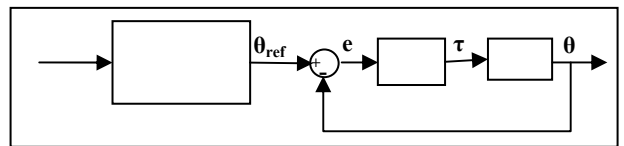
L



[]

()

[]



$$(F + a)(v + b) = (F_0 + a)b$$

v

()

F

F₀

b a

⁷ anthropomorphic

⁸ Hill's three-element model

⁹ Phenomenological

¹⁰ Contractile Element

¹ Flexion

² Extension

³ Pronation

⁴ Supination

⁵ Biceps Brachii

⁶ Triceps Brachii

$$u = b_0 + b_1\theta + b_2\theta^2 + b_3\theta^3 \quad (1)$$

$$V_0 = \dots \quad (2)$$

τ

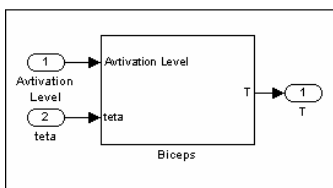
θ

$$MA = a_0 + a_1\theta + a_2\theta^2 + a_3\theta^3 + a_4\theta^4 + a_5\theta^5 \quad (3)$$

$b_i \quad a_i$

[]

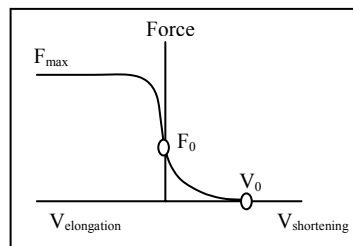
()



:

[]

[]



:

$$f - k_p u = \beta \cdot f_{CE} \left[\left(1 + \frac{k_p}{k_s} \right) \dot{u} - \frac{\dot{f}}{k_s} \right], \quad l_0 \quad (4)$$

u

f

l_0

\dot{u}

β

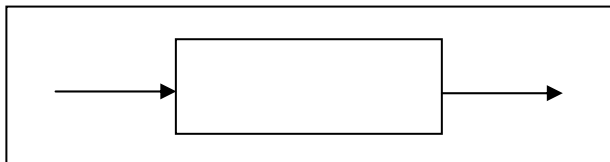
() ()

[]

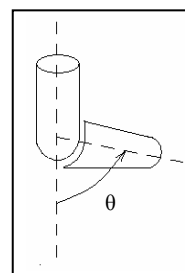
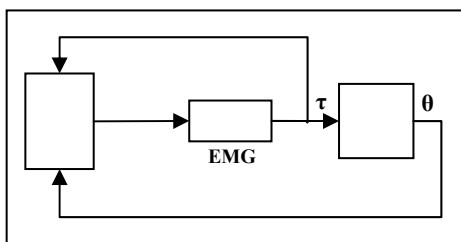
()

Muscle	Volume (cm ³)	L ₀ ^M (cm)	PCSA (cm ²)	F ₀ ^M (N)	V ₀ (mm/s)	a (N)	b (mm/s)	a' (N)	b' (mm/s)
Biceps	365.84	14.2	25.9	849.3	2275	212.3	568.8	212.3	426.6
Triceps	619.99	8.77	76.3	2333	1403	583.2	350.8	583.2	263.1

()



:



:

θ

()

θ

:

² Moment Arm

¹ Activation Level

Triceps Biceps

()

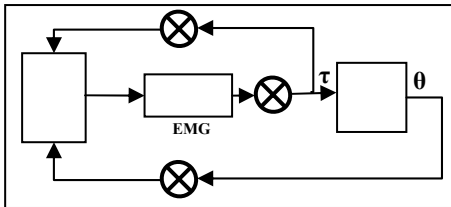
AL_gen

AL

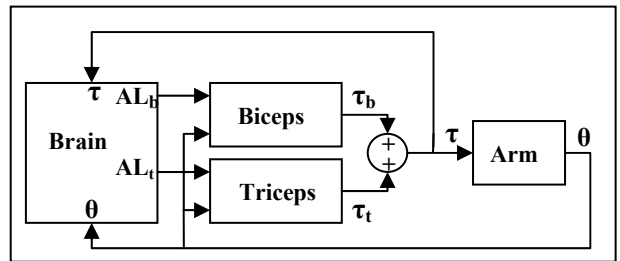
AL

Path_gen

()



()

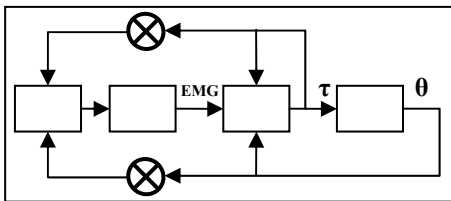


Brain

AL

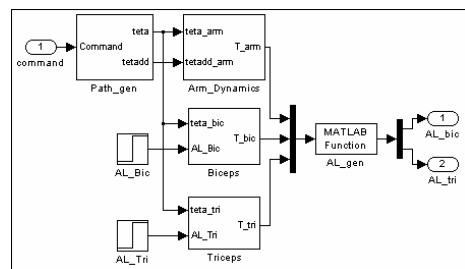
AL

()



()

AL



AL

command

EMG

Path_gen

EMG

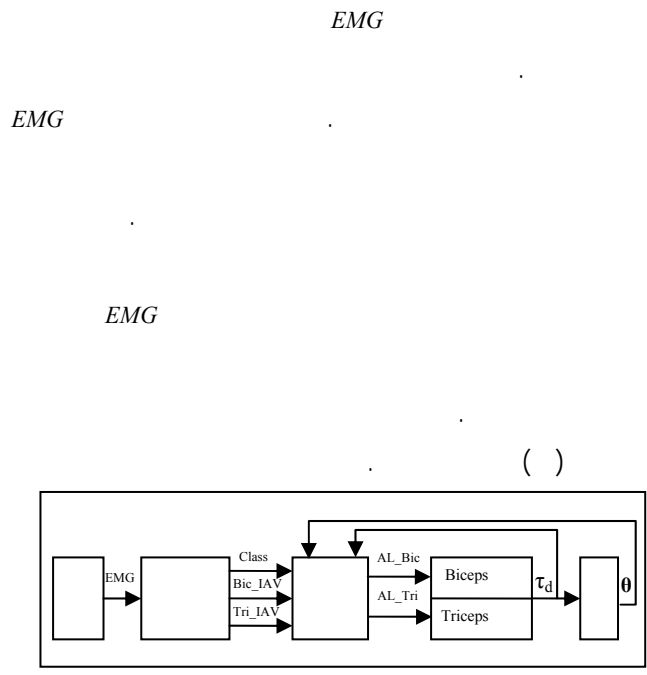
Triceps Biceps Arm_Dynamics

Arm_Dynamics

¹ Feed back

\dot{I}
 \dot{I}
 \dot{I}
 \dot{I}
 \dot{I}

EMG
 ()
 ()
 ()
 ()
 ()
 ()
 ()



EMG IAV

()

AL

AL

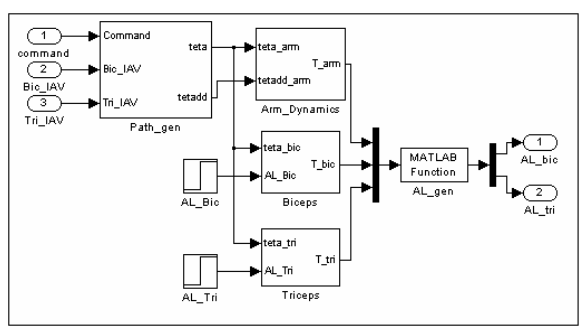
IAV

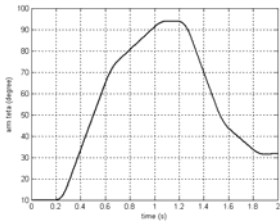
Path_gen

EMG IAV

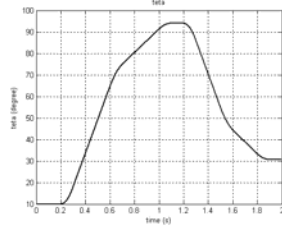
EMG

()

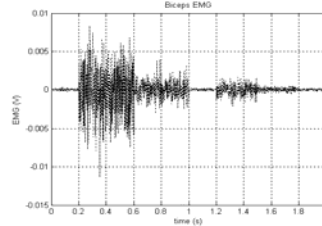




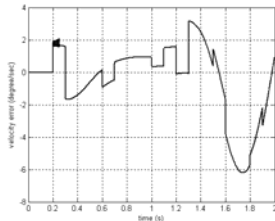
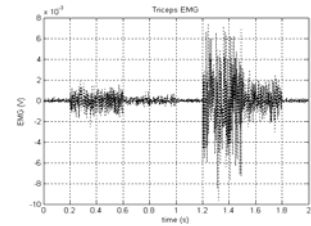
()



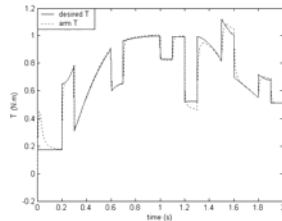
()



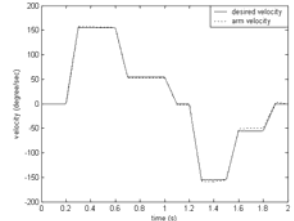
()



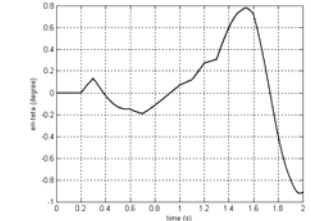
()



()



()



()

((() ())) *EMG* (:

((

EMG

[]

[]

DC

[]

)
(

[]

[]

[]

[]

[11] Herzog, W., Epstein, M., *Theoretical Models of Skeletal Muscle*, John Wiley & Sons, 1998

[12] Garner, B. A., Pandy, M. G., *Estimation of Musculotendon Properties in the Human Upper Limb*, *Annals of Biomedical Engineering*, Vol. 31, pp. 207–220, 2003

[13] Lemay, M. A., Crago, P. E., *A Dynamic Model for Simulating Movements of the Elbow, Forearm, and Wrist*, *J. Biomechanics*, Vol. 29, No. 10, pp. 1319-1330. 1996

[]

[]

[]

[]