Muscle Performance Evaluation

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Muscle Force

- Qualitative
- the faster motion, the bigger amplitude

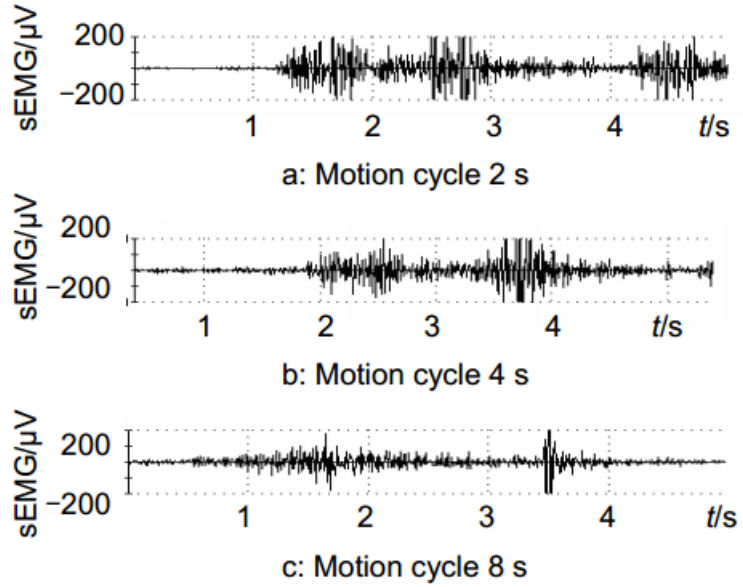
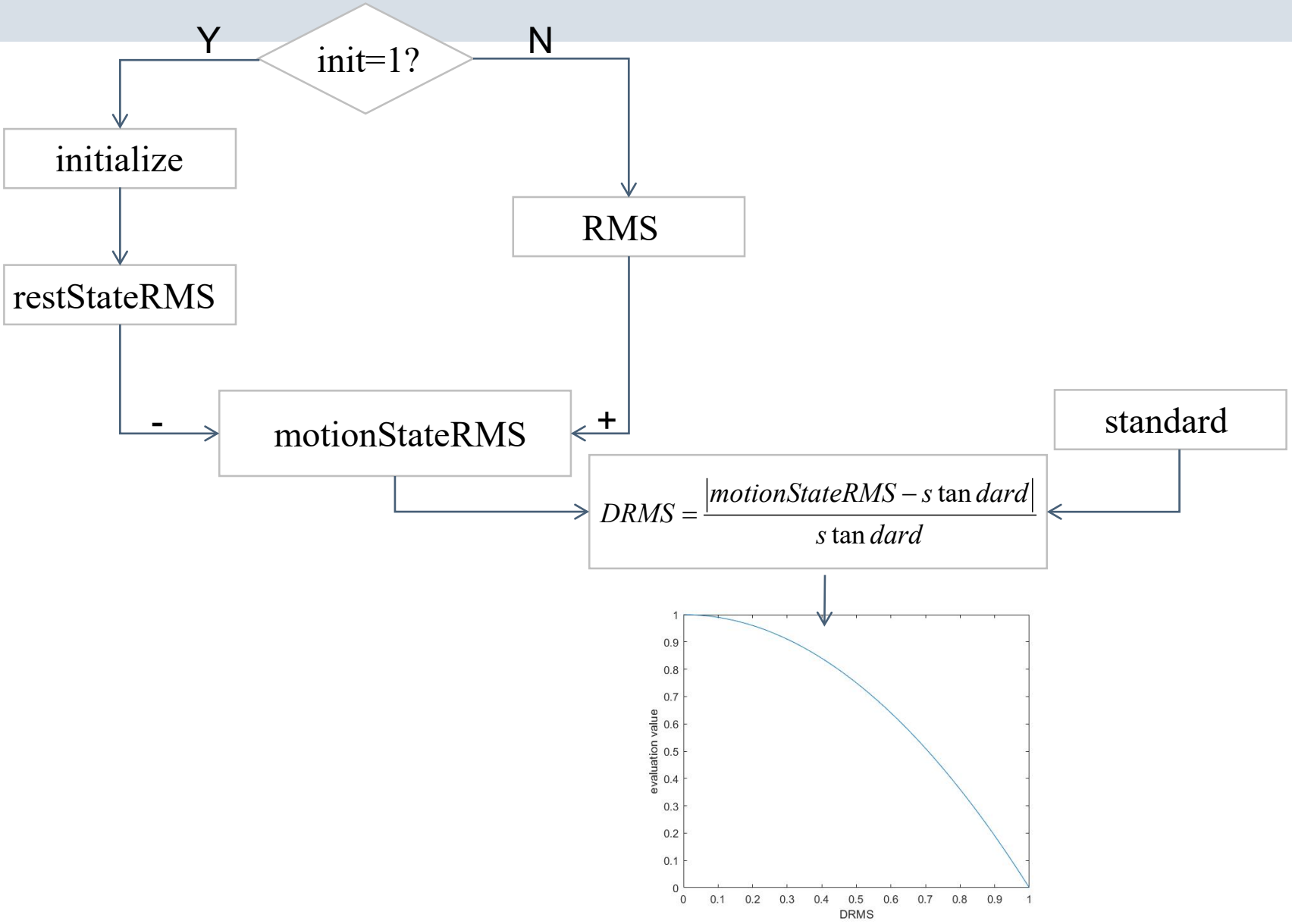


Figure 2 Surface electromyography signal in the condition of different velocity

图 2 不同速度下采集的 sEMG

吴冬梅.孙兴.张志成.杜志江.表面肌电信号的分析和特征提取[J].沈阳:中国组织工程研究与临床康复,2010.

Muscle Force



Muscle Force

- Quantitative
- acquire isometric force via Hill-Model
- joints don't moving

$$p(t) = \gamma e(t-d) - \beta_1 p(t-1) + \beta_2 p(t-2)$$

p(t): neural activation $0 < p(t) < 1$

e(t): RSEMGS 经过信号处理之后的 EMG 信号

d: electromechanical delay

$$\beta_1 = C_1 + C_2 \qquad \beta_2 = C_1 C_2 \qquad |C_1| < 1, |C_2| < 1$$

$$\gamma = \beta_1 + \beta_2 + 1$$

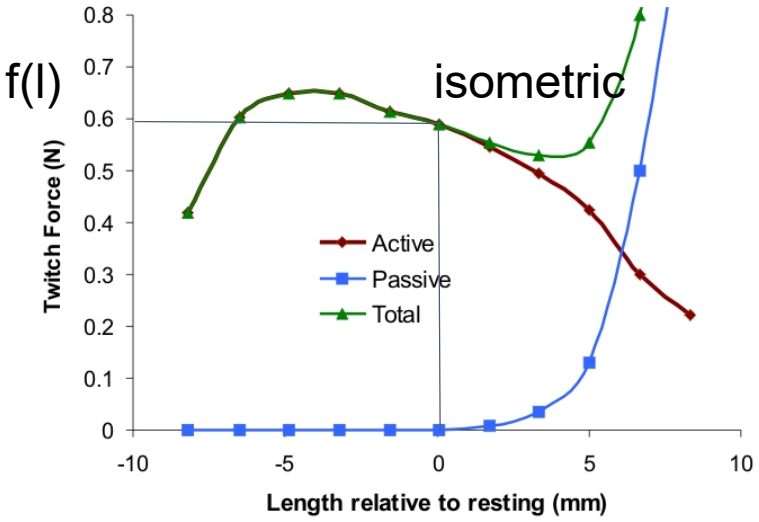
$$a(t) = \frac{e^{Ap(t)} - 1}{e^{A} - 1}$$

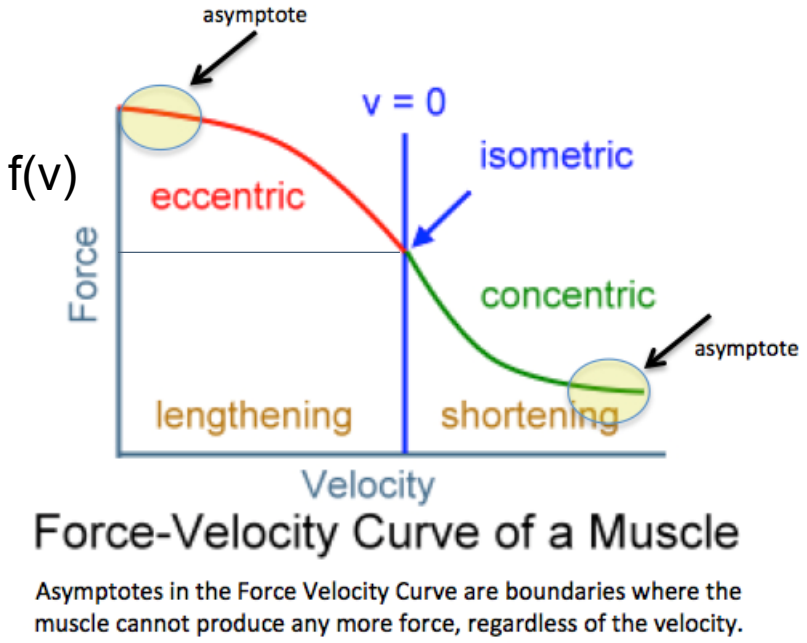
a(t): nonlinear activation force

A: nonlinear shape factor(-1)

$$\mathrm{F} = F_0 a(t) f(v) f(l)$$

Hill-Model



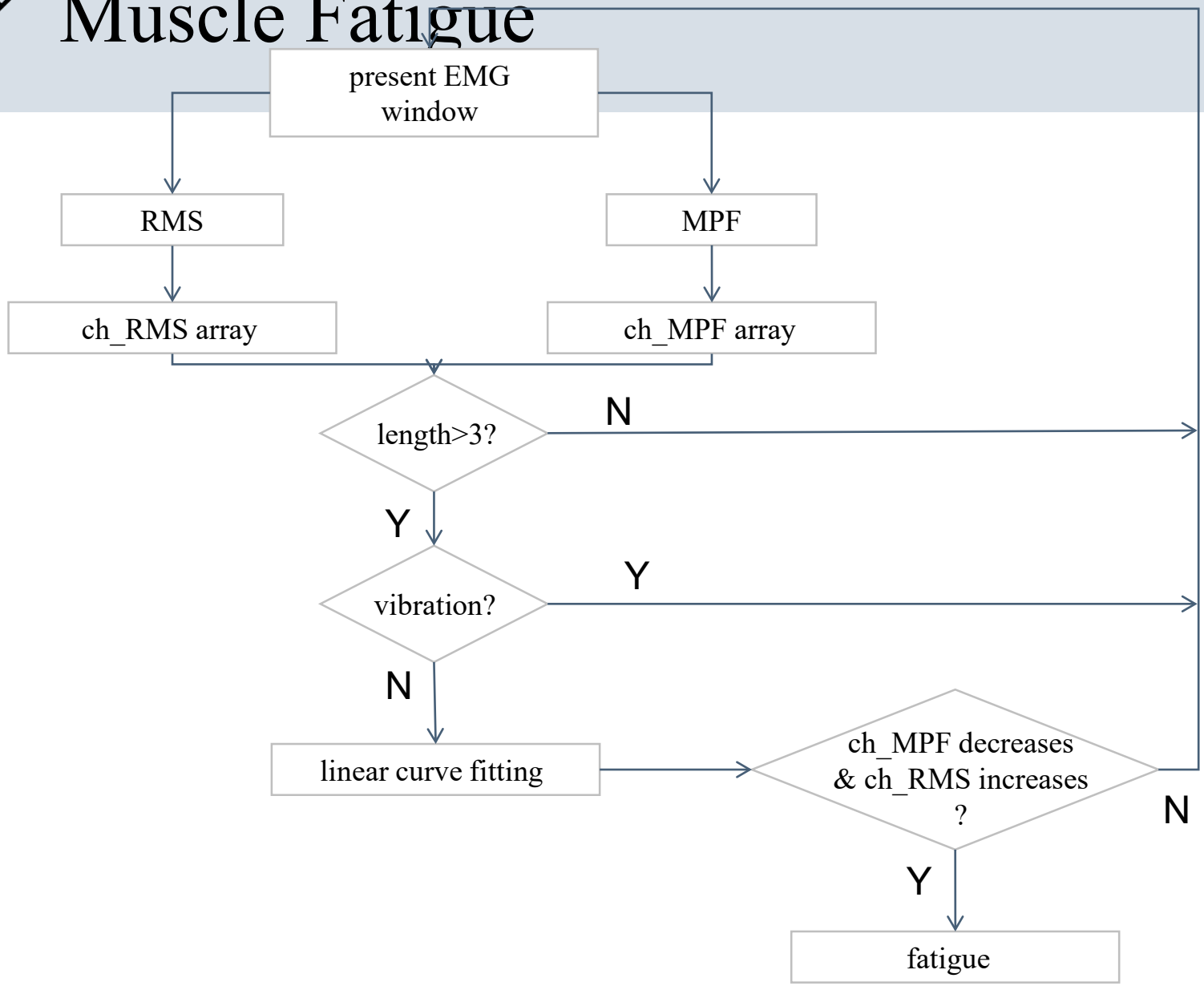


f(l):force-length relation
f(v):force-velocity relation

Muscle Fatigue

- Criterion
- increase in amplitude(Roor Mean Square)
- transition from high frequency spectrum to low frequency spectrum (Mean Power Frequency)

Muscle Fatigue



Thanks