A adapted trans iso Mooney-Rivlin model (Gordon 1966)

1. Introduction

This plugin uses the pre-implemented material type ‘transversal isotropic Mooney-Rivlin’ as a basis. It replaces the implemented active contraction contribution with the force-length curve from Gordon et al. (1966). This allows you to easily change the muscle properties for different muscle types for quasi-static simulations.

The original contribution of active contraction comes from:

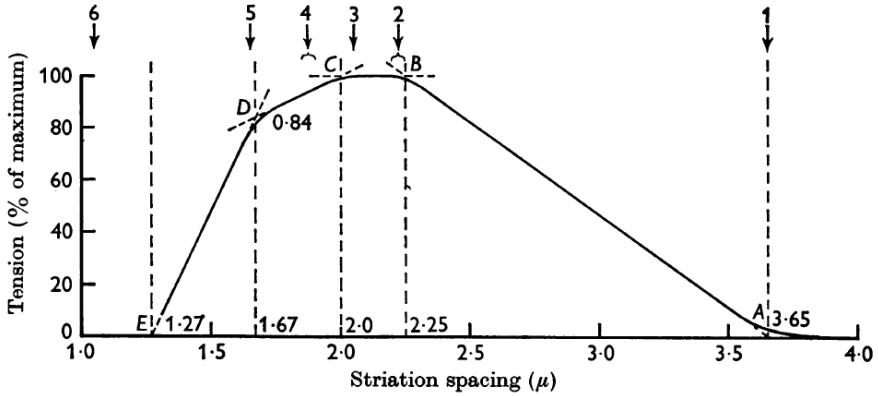

Fig. 12. Schematic summary of results. The arrows along the top are placed opposite the striation spacings at which the critical stages of overlap of filaments occur, numbered as in Fig. 14.

Fig. 1: Force-length diagram from Gordon et al. (1966).

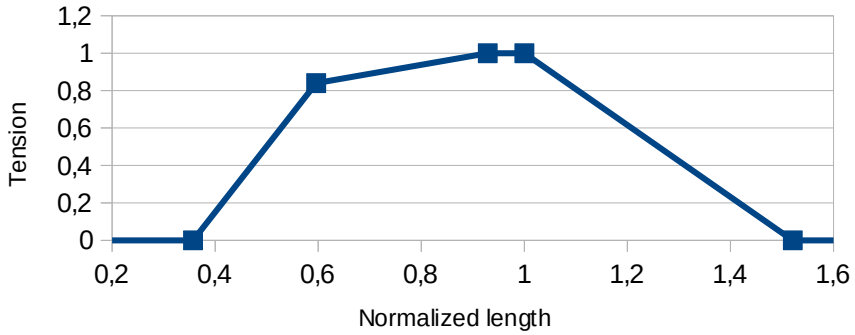

Fig. 2: Force-length diagram for the normalised length.

2. Adaptation

Implementation of the

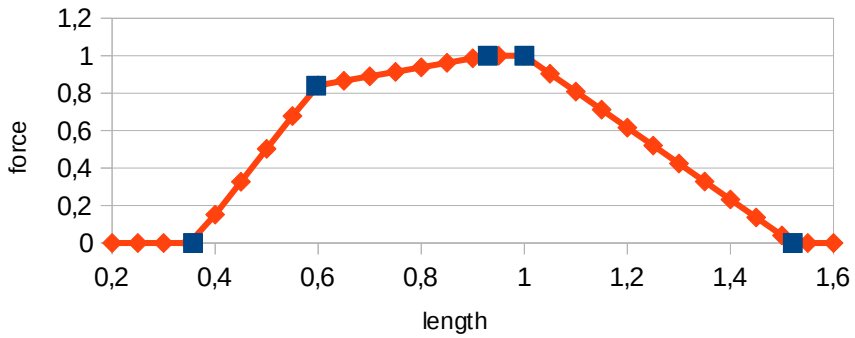

Fig. 3: Force-length diagram for the normalised length.

```
m_ax = 0.357;
m_ay = 0;
m_bx = 0.596;
m_by = 0.84;
m_cx = 0.929;
m_cy = 1;
m_dx = 1;
m_dy = 1;
m_ex = 1.521;
m_ey = 0;

if (m_ascl > 0)
	{
		double ctenslm = m_ascl; // activation scale factor
		double Wl = 0;
		/*if (lamd < m_ax) Wl = 0;
		else*/ if (lamd < m_bx) Wl = m_ay + (lamd-m_ax)*((m_by-m_ay)/(m_bx-m_ax));
		else if (lamd < m_cx) Wl = m_by + (lamd-m_bx)*((m_cy-m_by)/(m_cx-m_bx));
		else if (lamd < m_dx) Wl = m_cy + (lamd-m_cx)*((m_dy-m_cy)/(m_dx-m_cx));
		else if (lamd < m_ex) Wl = m_dy + (lamd-m_dx)*((m_ey-m_dy)/(m_ex-m_dx));
		/*else Wl = 0;*/
		saf = ctenslm * (m_smax * Wl); // activation * (max stress * W on lamd)
	}
```

3. Versions

Gordon1966_R3

febio4 (4.10) – 2025

Gordon1966_R2

febio2 (2.2.6) – 2018

Gordon1966_R

febio – 2016

4. Example

```
<material id="1" lc="1" type="gordon1966">
    <c1>0.1152</c1> <!-- MPa - Vogt 2006 -->
    <c2>0.0540</c2> <!-- MPa - Vogt 2006 -->
    <c3>0.05</c3> <!-- dimensionless - Röhrle 2008 -->
    <c4>6.6</c4> <!-- dimensionless - Röhrle 2008 -->
    <c5>2.1751</c5> <!-- dimensionless - Röhrle 2008 -->
    <k>2.08</k> <!-- MPa - 100 < K/C1 < 10000 - water=2.08E9 -->
    <lam_max>1.4</lam_max>
    <smax>1</smax>
</material>

<loadcurve id="1">>
    <loadpoint>0,0</loadpoint>
    <loadpoint>1,1</loadpoint>
</loadcurve>
```

5. Literature

Gordon AM, Huxley AF, Julian FJ. The variation in isometric tension with sarcomere length in vertebrate muscle fibres. *The Journal of Physiology*. 1966;184(1):170-192.