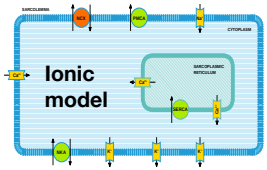
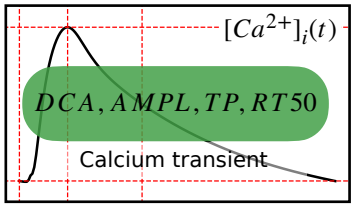
CELL





Ca^{2+}-TnC binding

$$\frac{dTRPN}{dt} = k_{on}\left(\frac{[Ca^{2+}]_i}{Ca_{T50}}\right)^{n_{trpn}}(1-TRPN) - k_{off}\,TRPN$$

Length dependence

$$Ca_{T50} = Ca_{50}\,[1+\beta_1(\lambda-1)]$$

Cross-bridge cycling

$$\frac{dXB}{dt} = k_{xb}\left[pt\,(1-XB) - \frac{1}{pt}\,XB\right], \quad pt = \left(\frac{TRPN}{TRPN_{50}}\right)^{\frac{n_{xb}}{2}}$$

Active tension generation

$$T = T_{ref}\cdot g(d\lambda/dt)\cdot h(\lambda)\cdot XB$$

TISSUE

Cardiac strain energy function

$$W = W_g - p(J-1) + \frac{\kappa}{2}(J-1)^2$$

Transversly isotropic constitutive law

$$W_g = \frac{1}{2}\,C_1\,(e^{Q(\mathbf{E})}-1)$$

$$Q(\mathbf{E}) = C_2\,E_{ff}^2 + C_3\,(E_{ss}^2 + E_{nn}^2 + 2E_{sn}^2) + 2C_4\,(E_{fs}^2 + E_{fn}^2)$$

VASCULAR SYSTEM

Three-element Windkessel model

$$\frac{dv_{LV}}{dt} = \frac{1}{Z}\,(p_{ao} - p_{LV}) \qquad I_{out} = \frac{1}{R}\,p_{ao}$$

$$\frac{dv_{ao}}{dt} = -I_{out} - \frac{dv_{LV}}{dt} \qquad p_{ao} = \frac{1}{C}\,v_{ao}$$

$$\frac{dp_{LV}}{dt} = \kappa_{diast}\,(p - p_{LV})$$

INPUTS

$DCA, AMPL, TP, RT50$ — calcium properties

+

$Ca_{50}, \beta_1, k_{off}, n_{trpn}, k_{xb}, n_{xb}, TRPN_{50}, T_{ref}$ — sarcomere properties

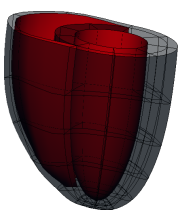
+

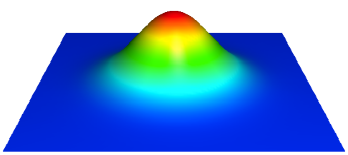
p, p_{ao}, Z — hemodynamic properties

+

C_1 — tissue property

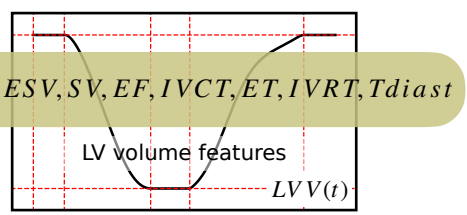
deterministic mapping
(full model simulator)





probabilistic mapping
(Gaussian process emulator)

OUTPUTS



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