**Micromechanics of Elastic Lamellae – Unraveling the Role of Structural Inhomogeneity in Multi-Scale Arterial Mechanics**

Xunjie Yu1, Raphaël Turcotte2, Francesca Seta3, and Yanhang Zhang1,4\*

1Department of Mechanical Engineering, Boston University, Boston, MA

2Department of Pharmacology, University of Oxford, Oxford, United Kingdom

3Vascular Biology Section, Boston University School of Medicine, Boston, MA

4Department of Biomedical Engineering, Boston University, Boston, MA

**\*Corresponding author:**

Yanhang (Katherine) Zhang

Department of Mechanical Engineering

Department of Biomedical Engineering

Boston University

110 Cummington Mall

Boston, MA 02215

Email: yanhang@bu.edu

Phone: (617)358-4406

Fax: (617)353-5866

**Table S1**. Summary of model parameters and root-mean-square error (RMSE) for all five carotid arteries obtained by fitting the pressure (Equation (5)) and axial force (Equation (6)) from the model and experimentally measured data based on least square fit in Equation (10). Average model parameters were calculated and used for stress analysis in the thick-wall model, from which the tissue circumferential stretch was calculated.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample number** | $$C\_{e}$$ | $$k\_{1}^{1}$$ | $$k\_{2}^{1}$$ | $$β$$ | $$k\_{1}^{2}$$ | $$k\_{2}^{2}$$ | $$k\_{1}^{3, 4}$$ | $$k\_{2}^{3,4}$$ | **RMSE** |
| 1 | 13.69 | 1.77 | 0.48 | 39.42 | 6.39 | $$4.39×10^{-5}$$ | 4.63 | $$3.75×10^{-6}$$ | 0.08 |
| 2 | 15.66 | 0.29 | 0.88 | 40.75 | 8.33 | $$1.91×10^{-5}$$ | 5.06 | $$1.03×10^{-5}$$ | 0.11 |
| 3 | 15.62 | 0.40 | 0.82 | 46.32 | 6.87 | $$1.55×10^{-5}$$ | 5.29 | $$8.58×10^{-6}$$ | 0.09 |
| 4 | 19.57 | 0.32 | 0.73 | 39.83 | 11.84 | $$9.69×10^{-6}$$ | 7.03 | $$9.52×10^{-6}$$ | 0.06 |
| 5 | 11.26 | 0.84 | 0.51 | 42.45 | 9.07 | $$1.60×10^{-6}$$ | 6.51 | $$1.64×10^{-5}$$ | 0.10 |
| Mean | 16.13 | 0.70 | 0.73 | 41.58 | 8.36 | $$2.20×10^{-5}$$ | 5.50 | $$8.03×10^{-6}$$ | 0.09 |
| SD | 3.06 | 0.63 | 0.18 | 2.80 | 2.16 | $$1.59×10^{-5}$$ | 1.02 | $$4.52×10^{-6}$$ | 0.02 |



**Figure S1. A**:Outer diameter vs. pressure, and **B**: axial force vs. pressure for all five mouse carotid arteries from pressure-diameter test (open symbols) and from modeling (solid lines). Carotid arteries were subjected to 1.6 axial stretch while being pressurized from 0-140 mmHg. The thicker solid lines represent the modeling prediction using the average material parameters from Table S1.