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Fractional-order viscoelasticity in one-dimensional blood flow models[1] PARIS PERDIKARIS, GEORGE KARNIADAKIS, Brown University, CRUNCH GROUP TEAM — In this work, we have integrated different integer, and for the first time, fractional order viscoelastic models in a one-dimensional blood flow solver, and we study their behavior by presenting an in-silico study on a patient-specific arterial network. Integer-order models are directly derived from the QLV (quasi linear viscoelasticity) theory and are comprised by simple combinations of springs and dashpots. Fractional-order models employ fractional derivatives and naturally introduce a new element, the so called "spring-pot." We perform one-dimensional blood flow simulations in a large patient-specific cranial network using four different viscoelastic parameter data-sets. The results aim to quantify the effect of arterial wall viscoelasticity on pulse wave propagation, as well as reflect any sensitivity on the input parameters that define each model. To this end, we provide a comparison of several viscoelastic models, highlight the important role played by the fractional order, and carry out a detailed global sensitivity analysis study on a stochastic fractional order viscoelastic model.

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