Mathematical Modelling of Hemodynamics

Simone Bonfiglio*[1], Carmelo Filippo Munafò[1] and Patrizia Rogolino [1]

[1]Department of Mathematical and Computer Sciences, Physical Sciences and Earth Sciences, University of Messina, Viale F. Stagno d'Alcontres 31, 98166, Messina Italy

simone.bonfiglio1@studenti.unime.it (*presenter)
carmelofilippomunafo@unime.it, progolino@unime.it

The physical and biological processes governing blood flow play a fundamental role in ensuring the safety and efficacy of all blood-wetted medical devices.

We develop a model for blood flow within the theoretical framework of interacting continua, also referred to as mixture theory [1]. In the proposed formulation, following the papers of Massoudi et al. [2, 3] , blood is regarded as a two-component mixture consisting of red blood cells (RBCs) suspended in plasma. The plasma phase is modeled as a linearly viscous Newtonian fluid, whereas the RBC phase is described as an anisotropic, nonlinear density-gradient-type fluid capable of capturing the inherent microstructural effects associated with cell deformation and aggregation. Biochemical processes and reactions are neglected, and attention is focused exclusively on the mechanical coupling between the two constituents. This theoretical framework provides a rigorous basis for investigating the non-Newtonian rheological behavior of blood.

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References

[1] Rajagopal, K.R., Tao, L. (1995) Mechanics of mixtures. *In Series on Advances in Mathematics for Applied Sciences*, World Scientific, Singapore.

[2] Massoudi, M., Rajagopal, K.R., Phuoc, T.X.,(1999). On the fully developed flow of a dense particulate mixture in a pipe, *Powder Technology*,Volume 104, Issue 3, Pages 258-268, ISSN 0032-5910, https://doi.org/10.1016/S0032-5910(99)00103-5.

[3] Massoudi, Mehrdad, Antaki, James F., (2008). An Anisotropic Constitutive Equation for the Stress Tensor of Blood Based on Mixture Theory, *Mathematical Problems in Engineering*, 579172, 30 pages, 2008. https://doi.org/10.1155/2008/579172