Abstract Submitted
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From ab-initio Mesoscale Modelling of Red Blood Cells Towards Macroscale Simulations in Biomedical Devices[1] FABIO GUGLIETTA, LUCA BIFERALE, GIACOMO FALCUCCI, MAURO SBRAGAGLIA, University of Rome "Tor Vergata", MAREK BEHR, RWTH Aachen University, GIANNIS KOUTSOU, The Cyprus Institute — Ventricular assist devices (VADs) are mechanical pumps which are designed to assist the blood circulation in people with heart problems. One important challenge is to minimise the blood damage (haemolysis) in the pump; to this aim, computational fluid dynamics has gained an increasing deal of attention in the recent years. The most recent computational fluid dynamics approaches use tensor-based (TB) models, wherein the red blood cells (RBCs) are modelled as deforming suspensions evolving in the flow, and their deformation is used to measure the shear stress and correlate it to the haemolysis. The aim of this work is to improve the TB model through ab-initio simulations of the single RBC. Specifically, we have used a hybrid Immersed Boundary-Lattice Boltzmann Method (IB-LBM) code to perform numerical simulations of a single RBC suspended in a simple shear flow. After a validation of the IB-LBM model, the ab-initio simulations will be interfaced with TB models and quantitative comparisons of the deformation history coming from both models will be provided. The expected outcome is a quantitative protocol to adapt the TB model parameters to the flow and structure properties.

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