Introduction
The study of the shear stress exerted by the blood on the vessel is crucial for the understanding the inherent mechanisms of severe cardio-vascular diseases. Although the structure of blood is very complex, consisting of a suspension in plasma of formed elements, its rheological properties are determined by the behaviour of erythrocytes, the greatest in proportion cells, at different shear rates. As the blood flows through the vessel, the Non-Newtonian effects become more important as the diameter of erythrocytes becomes comparable to the diameter of the vessel. Several constitutive models have been developed in order to present the viscoelastic, shear-thinning and thixotropic character of the blood flow. The current work aims to the development of a stable numerical framework for the simulation of two different models in realistic geometries and to compare their estimations.

Methods
The current study deals with the numerical simulation of two rheological models for blood in stenotic tubes under steady-state and pulsating conditions: the homogeneous and non-homogeneous models proposed by Owens (2006) and Moyers-Gonzalez et al. (2008). Both models are viscoelastic and account for the contribution of the RBC to Cauchy stress tensor via their fragmentation and aggregation rates into rouleaux. The second model is an improvement of the homogeneous model that accurately predicts the Fahraeus (1929) and the Fahraeus-Lindqvist (1931) effects, and the shear stress. Systems (1) and (2) are the coupled systems of diffusion and constitutive equations of the homogeneous and non-homogenous model with respect that were obtained after inserting non-dimensional variables.

\[
\frac{\partial N}{\partial t} + \frac{1}{2} b c (N - N_p)(N + N_p - 1) = 0
\]

\[
\varepsilon + \text{Deg} \frac{\partial}{\partial t} \varepsilon = 2(1 - \beta) N_p \frac{\partial N}{\partial t} \tag{1}
\]

\[
\varepsilon + \text{Deg} \frac{\partial}{\partial t} \varepsilon = (1 - \beta) N_p \frac{\partial N}{\partial t} \tag{2}
\]

The numerical method of Finite Elements is used in order to solve the above equations along with mass and momentum balances and calculate the shear stress along the wall.

Results & Discussion
The work provides a complete parametric analysis based on ten dimensionless parameters along with calculations of the drag force on the tube wall and the pressure drop within deformable and rigid vessels. The results present the viscoelasticity and shear-thinning character of blood. Finally, the simulation of the time-dependent homogeneous flow shows the development of a cell-depleted layer near the wall, as predicted from the Fahraeus & Lindqvist effect (1931).

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References
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