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MULTI-COMPONENT RED BLOOD CELL COMPUTATIONAL MODELING: A NEW MATHEMATICAL FORMULATION

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Abstract.

In this article, we present a new mathematical/computational formulation for a multicomponent model to study the normal and pathological behaviour of red blood cells in slow transient processes. We take into account (i) the lipid bilayer behaviour, (ii) the cytoskeleton dynamics, (iii) the interaction activity between them, and (iv) the internal cytoplasm flow. The formulation considers the cytoskeleton as a discrete non-linear elastic structure. The first novelty is to couple it with continuum models of the lipid membrane and of the cytoplasm, instead of the usual discrete/particle models. The second novelty is that the interaction of the cytoskeleton with the membrane is through adhesion forces adapted from efficient solid-solid adhesion algorithms. The model is tested with virtual experiments such as relaxation towards equilibrium and stretching by optical tweezers.