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A TWO-COMPONENT FLUID-SOLID FINITE ELEMENT MODEL OF THE RED BLOOD CELL

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Abstract. The state of the art models for the red blood cell consist of two components: A solid network of fibers (worm-like chains) that correspond to the cytoskeleton, and a fluid surface with bending stiffness that corresponds to the lipid bilayer (X. Li et.al., *Phil. Trans. R. Soc. A*, 372:20130389 (2014)). The fluid and solid components are connected at the junctions of the network, where trans-membrane proteins anchor the bilayer to the cytoskeleton, but this connection is not rigid and under large deformations it is possible that cytoskeleton and bilayer detach from one another. It is well know that the interactions between the lipid bilayer membrane and the skeletal network (fluid-solid interactions) are responsible for the physical properties of red blood cell. However, quantifying these interactions and studying the related dynamics is still a topic discussed and full of open questions (S. Lux, *Blood*, 127:187–199 (2016)). In this work we will report on our first advances towards the development of a finite element method for this strongly coupled system. It leads to a fluid-structure interaction problem, with the salient feature that both the fluid and the structure are in fact two-dimensional bodies evolving in three-dimensional space.