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Immersed boundary peridynamics (IB/PD) method to simulate aortic dissection[1] AMNEET PAL SINGH BHALLA, BOYCE GRIFFITH, University of North Carolina at Chapel Hill — Aortic dissection occurs when an intimal tear in the aortic wall propagates into the media to form a false lumen within the vessel wall. Rupture of the false lumen and collapse of the true lumen both carry a high risk of morbidity and mortality. Surgical treatment consists of either replacement of a portion of the aorta, or stent implantation to cover the affected segment. Both approaches carry significant risks: open surgical intervention is highly invasive, whereas stents can be challenging to implant and offer unclear long-term patient outcomes. It is also difficult to time optimally the intervention to ensure that the benefits of treatment outweigh its risks. In this work we develop innovative fluid-structure interaction (FSI) model combining elements from immersed boundary (IB) and peridynamics (PD) methods to simulate tears in membranes. The new approach is termed as IB/PD method. We use non-ordinary state based PD to represent material hyperelasticity. Several test problems are taken to validate peridynamics approach to model structural dynamics, with and without accounting for failure in the structures. FSI simulations using IB/PD method are compared with immersed finite element method (IB/FE) to validate the new hybrid approach.

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