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Wall shear stress fixed points in cardiovascular fluid mechanics

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Abstract

Complex blood flow in large arteries creates rich wall shear stress (WSS) vectorial features. WSS acts as a link between blood flow dynamics and the biology of various cardiovascular diseases. WSS has been of great interest in a wide range of studies and has been the most popular measure to correlate blood flow to cardiovascular disease. Recent studies have emphasized different vectorial features of WSS. However, fixed points in the WSS vector field have not received much attention. A WSS fixed point is a point on the vessel wall where the WSS vector vanishes. In this article, WSS fixed points are classified and the aspects by which they could influence cardiovascular disease are reviewed. First, the connection between WSS fixed points and the flow topology away from the vessel wall is discussed. Second, the potential role of time-averaged WSS fixed points in biochemical mass transport is demonstrated using the recent concept of Lagrangian WSS structures. Finally, simple measures are proposed to quantify the exposure of the endothelial

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