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Quantification of disturbed wall shear stress patterns in complex cardiovascular flows AMIRHOSSEIN ARZANI, SHAWN C. SHADDEN, University of California Berkeley — Wall shear stress (WSS) affects the cardiovascular system in numerous ways, and is thought to play an important role in the pathology of many cardiovascular diseases. The (endothelial) cells lining the inner wall of blood vessels, and perhaps the cells inside the vessel wall, can actively sense WSS and respond both chemically and mechanically. The complexity of WSS in cardiovascular flows extends both spatially and temporally. Furthermore, WSS has magnitude and direction. These facets make simple quantification of WSS in cardiovascular applications difficult. In this study we propose a framework to quantify measures such as WSS angle gradient, WSS magnitude gradient, WSS angle time derivative and WSS magnitude time derivative. We will explain the relation of these parameters to the tensorial WSS gradient and WSS vector time derivative, and propose a new methodology to unify these concepts into a single measure. The correlation between these metrics and more common WSS metrics used in the literature will be demonstrated. For demonstration, these methods will be used for the quantification of complex blood flow inside abdominal aortic aneurysms.

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