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Wall shear stress manifolds and surface temperature patterns in heat transfer enhancement applications[1] CONNOR MORENO, AMIRHOSSEIN ARZANI, Northern Arizona University — Heat transfer enhancement has applications in many of the devices used by the public, directly or indirectly, on a daily basis. However, high-resolution heat transfer simulations are computationally costly, representing significant downtime in engineering industry and research. Meanwhile, wall shear stress (WSS) topology has been recently demonstrated as an effective estimator of surface concentration patterns in convective mass transport settings. Particularly, stable and unstable manifolds in WSS have been shown to control near-wall transport patterns in cardiovascular flows. Estimating surface concentration/temperature via WSS is desirable because of the significant reduction in computational time and the physical explanation of the results. In this study, it is investigated whether WSS topology proves an effective estimator of surface temperature patterns in heat transfer settings. The configuration used is the classical impinging jet, a widely used heat transfer enhancement application. WSS is obtained by computational fluid dynamics simulations and surface temperature is obtained by solving the advection-diffusion equation, both using the finite element method. Our results demonstrate a close connection between WSS manifolds and surface temperature patterns.

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