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Hemodynamics of Aortic Stenosis and Implications for Non-invasive Diagnosis via Auscultation[1] CHI ZHU, JUNG-HEE SEO, RAJAT MITTAL, Johns Hopkins Univ — Aortic stenosis refers to the abnormal narrowing of the aortic valve and it is one of the most common valvular diseases. It is also known to generate ejection murmurs, which contain valuable disease-related information. However, an incomplete understanding of the flow mechanism(s) responsible for the murmur generation, as well as the effect of intervening tissue on murmur propagation has limited the diagnostic information can be extracted through cardiac auscultation. In this study, a canonical model of the aorta with stenosis is used, and a multiphysics computational modeling approach is employed to investigate the generation and propagation of the murmurs. First, direct numerical simulation (DNS) is used to explore the hemodynamics of the post-stenotic flow. Then, a high-order, linear viscoelastic wave solver is used to investigate the wave propagation in a modeled thorax. The results show that both the aortic jet and the secondary flow contribute significantly to the murmur generation. The murmur signals on the epidermal surface are measured and analyzed. The break frequencies obtained from the spectra of cases with different degrees of stenosis are found to follow a universal scaling. The implications of these results for cardiac auscultation are discussed.

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