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Pulsatile flows in biomedical applications

Pulsatile flows, unsteady phenomena, coherent vortical structures, and transitional or turbulent flows at low Reynolds numbers occur in the human body. Examples of pathological blood flow in which unsteadiness, separation and turbulence are important include regurgitant heart valves, stenosis or blockages, stents, and arterial branches and bifurcations. Speech production involves unsteady pulsatile flow and turbulent structures that affect the aeroacoustics and fluid-tissue interaction. The overall goal of our cardiovascular-inspired research program is to understand secondary flow structures in arteries and to assess their potential impact on vascular health and disease progression. The richness of morphologies and physics of secondary flow vortical structures and their formation and subsequent loss of coherence during deceleration phases suggests implications related to the blood flow in diseased, stented and stent-fractured conditions. The goal of our human phonation research program is to investigate the dynamics of flow past the vocal folds (VF) and the aerodynamic interaction with the VF. Studies are performed under both normal and pathological conditions of speech. In particular, recent attention has been focused on understanding the aging voice. Our overarching motivation for studying flows relevant to biomedical applications is to facilitate evaluation and design of treatment interventions and for surgical planning, i.e. to enable physicians to assess the outcomes of surgical procedures by using faithful computer simulations.

Biography

Michael W Plesniak is Professor and Chair of the Department of Mechanical and Aerospace Engineering at the George Washington University, with a secondary appointment in the Department of Biomedical Engineering. He earned his PhD degree from Stanford University and his MS and BS degrees from the Illinois Institute of Technology; all in Mechanical Engineering. He is a Fellow of AIAA, ASME, APS, AIMBE and AAAS. He has authored over 250 refereed archival publications, conference papers and presentations, and has presented numerous invited seminars and keynote addresses. He received the 2017 ASME Fluids Engineering Award.

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