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Bioprosthetic Aortic Valve Diameter and Thickness Are Directly Related to Leaflet Fluttering: Results from a Combined Experimental and Computational Modeling Study JAE LEE, University of North Carolina at Chapel Hill, LAWRENCE SCOTTEN, LNS Consulting, ROBERT HUNT, Department of Mathematics, UNC Chapel Hill, THOMAS CARANASOS, Division of Cardiothoracic Surgery, Department of Surgery, UNC School of Medicine, JOHN VAVALLE, Division of Cardiology, Department of Medicine, UNC School of Medicine, BOYCE GRIFFITH, Departments of Mathematics, Applied Physical Sciences, and Biomedical Engineering, UNC Chapel Hill — Bioprosthetic heart valves (BHVs) are commonly used in surgical and percutaneous valve replacement, and surgical valves have been shown to have a time to reintervention of 10–15 years. Further, smaller-diameter surgical BHVs generally have higher-rates of prosthesis-patient mismatch than larger valves. Bioprosthetic aortic valves can flutter in systole, and fluttering is associated with fatigue and failure in natural and manufactured structures. The determinants of flutter in BHVs have not been well characterized, however, despite their potential to impact BHV durability. We use an experimental pulse duplicator platform and a computational model of this system to study the role of device geometry on BHV dynamics. We systematically characterize the impact of BHV diameter and leaflet thickness on fluttering dynamics. Ultimately, understanding the effects of device geometry on leaflet kinematics may lead to more durable valve replacements.

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