Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Monitoring Prosthetic Valve Status via In-Situ Pressure Sensors: Concept Evaluation using Supervised Learning Applied to Computational Hemodynamic Models[1] SHANTANU BAILOOR, JUNG-HEE SEO, Johns Hopkins University, LAKSHMI PRASAD DASI, Georgia Insititute of Technology, STEFANO SCHENA, Johns Hopkins Medical Institute, RAJAT MITTAL, Johns Hopkins University — Transcatheter heart valves (THV) suffer from clinically silent complications like subclinical leaflet thrombosis which may result in fatal outcomes for the patient. Such malfunction is detected incidentally during post-implant follow-up, and common imaging techniques are either invasive or expose the patient to radiation and are cost prohibitive. This informs a critical need for a novel, non-invasive and non-toxic continuous monitoring modality of THVs. We conduct a data-driven, in-silico investigation into the viability of wireless, remote monitoring of prosthetic aortic valve health using pressure microsensors. The strong coupling between leaflet status and downstream hemodynamics facilitates correlating pressure measurements at strategic locations in the vicinity of the THV with leaflet mobility. We developed reduced-order valve models capable of simulating a wide range of valve conditions. High-fidelity simulations of transvalvular flow in a canonical aorta model, with supervised learning methods determine optimal sensor configuration. Preliminary results demonstrate pressure measurements at as few as two discrete locations per valve leaflet can accurately predict its status ("Healthy"/ "Reduced mobility") and quantify its range-of-motion.

[1]NSF award 1511200

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Date submitted: 03 Aug 2020 Electronic form version 1.4