

Dynamics and Vibrations Laboratory

Department of Mechanical Engineering



The mission of the Dynamics and Vibration Laboratory is to investigate dynamic systems in biomedical engineering and biology with particular emphasis on non-linear and coupled behavior. The group's efforts can be divided into two thrust directions: research into diagnostic and clinical applications, and research into areas of biological and physiological importance. Thus our research is both applied and fundamental. Exploratory simulation of coupled nonlinear systems, experimental validation and development of focused numerical methods are common threads in all of our research.

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Our current research can be divided into five main groups with significant cross-fertilization: non-linear dynamics of cardiac fibrillation with a focus on early detection and diagnostics; cardiac valve bio-acoustics with a focus on early detection of valvular disease; simulation of neurological pattern generation with applications in robotics; development of medical devices; and signal processing. Simulation and analysis go hand in hand with experimental validation both in the lab and in clinical settings, with our ultimate aim being prototyping. Currently, two projects are in the prototyping stage: a fiber optic endoscope and a fiber optic tissue pressure and shear sensor.

Selected Recent Publications

Brown, C.M., Fauver, M.E., Reinhall, P.G., Seibel, E.J. "Mechanical Design and Analysis for a Scanning Fiber Endoscope," Proc. 2001 ASME Int. Mech Eng. Cong Exp.

Einstein, DR, Reinhall, PG, Nicosia, M, Cochran, RP, Kunzelman, K. "Dynamic Finite Element Implementation of a Nonlinear, Anisotropic, Pseudo-elastic Formulation for Biologic Tissue: Cardiac Valve Application", Annals of Biomedical Engineering 2001 (in review).

Schreuder AB, Reinhall PG, Poole JE, Bardy GH and the SCD-HeFT Investigators, "Value of Nonlinear Dynamic Measures in SCD-HeFT ICD Patients With or Without Ventricular Fibrillation, submitted to Circulation

Grande KJ, Cochran RP, Reinhall PG, Verrier ED and Kunzelman KS, "Re-Creation of Sinuses is Important for Aortic Valve-Sparing" Journal of Thoracic and Cardiovascular Surgery, 119(4):753-63,2000

Low LA, Reinhall PG, Storti DW, "A Numerical Investigation of Phase-Locked and Chaotic Behavior of Coupled van der Pol Oscillators", submitted to Journal of Vibration and Acoustics.

