NEURAL ENGINEERING SEMINAR SERIES

Some Computational Biomechanics Problems in Neural Engineering

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W306 Millennium Science Complex

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ABSTRACT:

Of late much attention has been focused on problems of reproducibility in the The research in the Penn State Center for Neural Engineering (CNE) is the source of very many interesting challenges for mathematical modeling and computation. This talk will outline some recent projects I have contributed to since joining the CNE and in which the solution of partial differential equations (PDEs) has a role to play. The methodologies we use are rooted in the Finite Element Method (FEM) and include arbitrary Lagrangian–Eulerian schemes as well as residual-based stabilization to circumvent inf-sup conditions. I will briefly describe our efforts in *computational microacoustofluidics* (with applications in lab-on-a-chip devices); *fluid–structure interaction (FSI) and poroelasticy* to answer some basic questions about waste clearance from the brain; and *deformation and fracture of blood clots* in the context of mechanical thrombectomy, the latter being a surgical intervention in the treatment of acute stroke. The talk will include an overview of general aspects of mathematical modeling and a description of a few of the recurring challenges that are part and parcel of developing these models and their computer implementation. The talk will conclude with an outline of some current and future work.

BIOGRAPHY:

Dr. Francesco Costanzo joined Penn State in 1995. He is currently a professor in the Engineering Science and Mechanics (ESM) department and a member of the Center for Neural Engineering. Prof. Costanzo, who is serving as the Senior Associate Department Head of ESM, holds graduate appointments in the Department of Mathematics, the Department of Mechanical Engineering, and the Department of Biomedical Engineering. Dr. Costanzo earned a Laurea cum Laude in Aeronautical Engineering at the Politecnico di Milano, Italy, in 1989. He then came to the USA on a Fulbright Scholarship and pursued a Ph.D. in Aerospace Engineering, which he earned in 1993 at Texas A&M University. His general research interest has always been the mathematical modeling of materials behavior and the development of associated computational schemes. Early in his career, he focused on dynamic crack and damage propagation. All of his current projects are focused on biomedical problems and they include computational microacoustofluidics, fluid transport in brain, and the modeling of blood clots.