POLITECNICO DI TORINO

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange

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Seminario on-line

Tuesday June 23, 2020 at 17:00
Hosted on: Zoom

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Elementary Mechanics Of The Mitral Valve

Dr Scianna introduces the seminar.

Abstract

This talk is devoted to the description of bare-bones mathematical models for the elementary mechanics of the mitral valve, when its leaflets close under the systolic pressure. The first toy model considers the leaflets as two rods that bend under the action of a pressure difference; they have one fixed endpoint and are partially in contact. We obtain the balance equations of the mechanical system exploiting the principle of virtual works and the contact point is identified by a jump condition. Moreover the problem can be simplified exploiting first integrals. Numerical integration of the differential system shows how the shape of the beams and the position of the contact point depend on the applied pressure.

A second model slightly more sophisticated is presented, in which we add also the chordae tendinae that are mathematically represented as a reactive distributed force. In this case the pressure difference during the systolic phase is balanced by the tension of the chordae tendinae and by the interaction between the flaps in contact. Numerical integrations are performed for physiological values of the parameters and the computed angles between the leaflets and the plane of the annulus are compared with the ones measured by anatomical studies and ultrasound imaging.

This is a joint work with D. Ambrosi, L. Deorsola, and S. Turzi.

Biography

Marta Zoppello is a post-doc in Mathematical Physics at Politecnico di Torino. Previously, she was a post-doc fello at the University of Padova. She received her PhD in Mathematics from the University of Padova, Italy, in 2016. From 2016, she made a one-year post-doc in mathematics at University of Trento and a two-years of post-doc in Mathematics at University of Padova. Her research interests are interdisciplinary. During the PhD thesis she studied geometric control theory and optimal control applied to deformable bodies immersed in a fluid. During the post-doc in Trento, she studied controllability properties of systems with hysteresis and optimal control problems on networks. Now she is exploring the controllability and optimal control issues of nonholonomic dynamical systems