UC RIVERSIDE | UNIVERSITY OF CALIFORNIA | Mechanical Engineering

ME 250 SEMINAR

Bifurcations in Linear-Threshold Dynamics for the Study of Epileptic Events

Federico Celi (Ph.D. student, UCR)

Epileptic seizures are characterized by an abnormal neuronal activity in the brain. Given the severity of this condition and its diffusion (10% of people world-wide experience at least one seizure episode in their lifetime), there has been a shared effort among different scientific communities to understand and fight this disease. Thanks to the wide availability of EEG readings of healthy and epileptic brains, several mathematical models aiming at characterizing and describing these behaviors have been proposed. In this short talk, we show that a network of coupled oscillators with linear-threshold nonlinearities can exhibit oscillations that are characteristic of epileptic seizures, and that the transition from normal to epileptic oscillations can be modeled as a bifurcation in the parameters of the system.

Robokrill: a drag-based metachronal robot.

Sara Oliveira Santos (Ph.D. student, UCR)

Metachronal swimming is prevalent in crustaceans swimming at intermediate Reynolds number, in which both viscosity and inertia effects are important. Metachronal, drag-based swimming in krill (sp. Euphausia superba) has been studied both to assess its ecological relevance as well as finding solutions for underwater locomotion at intermediate Reynolds numbers. While the use of submersible robots has proved useful to understand the benefits of metachrony and drag modulation as a means to propel forward, prominent questions regarding thrust generation remain unanswered. We designed and constructed a scaled-up robotic model with geometric and kinematic similarity, reproducing the swimming kinematics of the appendages of free-swimming krill. Our robotic design allows the analysis of fine-scale kinematics and vortex generation in the vicinity of interior limb segments and will allow us to investigate important characteristics of metachronal propulsion that can be used in the development of underwater robots, especially in highly complex environments.

Toward Wind Velocity Sensing in the Lower Atmosphere with Multirotor UAS

Javier Gonzalez-Rocha (postdoctoral fellow, UCR)

Measuring wind velocity near the Earth's surface is critical to understanding the surface-atmosphere interactions driving the dynamic state of the atmospheric boundary layer (ABL). How the ABL evolves with respect to space and time influences both natural and human-driven processes that impact the health and safety of the general public. Some examples include the transport of air pollutants and biological hazards, weather storm formation, and spread of wildfires. However, wind observation from conventional in-situ and remote sensors are cost prohibited and their effectiveness is limited over water and complex terrain. This talk will present a model-based wind sensing approach for targeted observations inside of the ABL with off-the-shelf multirotor unmanned aircraft system (MUAS). The model-based wind sensing framework presented for MUAS leverages flight dynamics modeling, system identification and state estimation techniques. Accuracy and bandwidth analysis of wind estimates obtained from kinematic particle, point mass, and rigid body models will be discussed. Finally, the talk will present the application of model-based wind sensing for search and rescue of persons in water and environmental monitoring.

THURSDAY, February 18, 2021 | ZOOM | 11:00 AM - 11:50 AM