ME Seminar

Unconventional Models, Mobility and Sensing in Bioinspired Swimming

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ABSTRACT

The immense versatility of animal locomotion made possible by exploiting a variety of physics at different scales suggests that engineered motion barely exploits what is possible. Modeling and intentional design for complex dynamics is important for locomotion of robots in unstructured environments, such as on or underwater, in the offroad environment or for soft and compliant robots with many degrees of freedom. This talk will describe some unusual models of terrestrial nonholonomic systems that can be useful surrogate models for fish-like swimming and lead to a novel means of propulsion with purely internal actuators. The models also inform the role of passive degrees of freedom in improving the agility of a swimmer and enabling hydrodynamic sensing of flow around a swimmer which is otherwise 'blind'. Some recent results using machine learning on sensing the ambient flow around a hydrofoil through its kinematics alone will be described. The surrogate models can be very useful for training a physics informed reinforcement learning agent in steps (a curriculum); this is especially important for swimming robots where large amounts of data from experiments or high fidelity simulations can be difficult to obtain. The talk will also briefly touch upon other areas of application for internal actuation and embodied sensing to offroad vehicles and a class of soft robots.

ABOUT THE SPEAKER

Phanindra Tallapragada is an associate professor of mechanical engineering at Clemson University. He obtained his Ph.D in Engineering Mechanics from Virginia Tech in 2010 and did post doctoral research at the University of North Carolina Charlotte. Earlier he obtained his B.Tech and M.Tech in Civil Engineering from the Indian Institute of Technology, Kharagpur. He joined Clemson University as an assistant professor in 2013. His research interests are in dynamical systems and bioinspired locomotion related to terrestrial motion, fish-like swimming and low Reynolds number swimming.

August 2, 2022, 11:30 am, MMCR, ME@IISc