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Title of the talk: Adaptive Control of an Autonomous Underwater Vehicle.

Abstract: Research on Autonomous Underwater Vehicle (AUV) has attracted increased attention of control and robotics engineering community in the recent years due to its many interesting applications such as in Defence organisations for underwater mine detection, region surveillance, oceanography studies, oil/gas industries for inspection of underwater pipelines and other marine related industries. These motion control algorithms necessitate accurate representation of AUV dynamics involving hydrodynamic damping, Coriolis terms, mass and inertia terms etc. Control design for an AUV is challenging owing parametric uncertainties arising from hydrodynamic parameters and external disturbances due to variation in oceanic currents.

Among various motion control algorithms, waypoint tracking has more practical significance for oceanographic surveys and many other applications. In order to implement waypoint motion control schemes, Line-of-Sight (LoS) guidance law is employed which is computationally less expensive. In this work, adaptive control schemes are developed to implement LoS guidance for an AUV. The parameters of this NARMAX model structure are identified on-line using Recursive Extended Least Square (RELS) method. Then an adaptive controller is developed for realization of the LoS guidance law for an AUV. Using the kinematic equation and the desired path parameters, a Lyapunov based backstepping controller is designed to obtain the reference velocities for the dynamics. Subsequently, a self-tuning PID controller is designed for the AUV to track these reference velocities. Using an inverse optimal control technique, the gains of the self-tuning PID controller are tuned on-line. The proposed control algorithms are verified first through simulation and then through experimentation on the prototype AUV.