“Recent advances in high-gain output feedback for nonlinear systems and applications to unmanned vehicles”

In this talk, an overview of recent advances in nonlinear control based on a new dynamic high-gain scaling based design will be presented. This design technique has been shown to be a highly flexible design methodology providing a unified framework for both state-feedback and output-feedback control of nonlinear systems of both lower triangular (feedback) and upper triangular (feedforward) structures and also to some systems without any triangularity properties. Furthermore, the design paradigm provides considerable robustness to parametric uncertainties, appended dynamics, and additive noise disturbances. The technique can be extended to adaptive and robust frameworks and also to decentralized control of large-scale systems. A central ingredient in the dynamic high-gain scaling based design is the solution of particular pairs of coupled Lyapunov inequalities.

An overview of other ongoing research activities at CRRL will also be presented. These include applications to control of unmanned vehicles such as rotary-wing and fixed-wing aircraft, underwater vehicles, and surface ships. Our efforts in auto-pilot design and hardware-in-the-loop simulator for unmanned vehicles will be presented. Finally, a low-resource obstacle avoidance and path-planning system (GODZILA) for these unmanned vehicles will also be outlined.