Input-Output Control and Open-Loop Modification

Abstract: All mathematical models of physical systems are, to some degree, uncertain. Robust control is a field of control systems that can provide a guarantee of stability and/or performance of a system subject to uncertainty, which is of paramount importance in the control of all physical systems. A popular robust control method is H-infinity control, which uses the well-known Small Gain Theorem to guarantee robust stability. In the first part of this talk, an alternative approach to robust stability using input-output theory is presented, with a focus on passive, interior conic, and negative imaginary systems. The second part of this talk will introduce open-loop modification techniques that enable the use of input-output control methods in practical applications. In particular, sensor/actuator combination and parallel feedforward control techniques are discussed and implemented in numerical examples of flexible robotic systems.

Bio: Ryan received his B.Eng. degree in Honours Mechanical Engineering from McGill University in 2013, and his M.Sc. and Ph.D. degrees in Aerospace Engineering from the University of Michigan - Ann Arbor, in 2015 and 2018, respectively. From 2017 to 2018 he worked as an intern and then a consultant for Mitsubishi Electric Research Laboratories in Cambridge, MA. Ryan is currently an Assistant Professor of Aerospace Engineering and Mechanics at the University of Minnesota - Twin Cities. His research interests include dynamic modeling and control systems, with a focus on robotic and aerospace applications, as well as robust and input-output control techniques.