A convex approach to control of nonlinear, delayed and PDE systems with application to magnetic confinement of plasma in fusion reactors.

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In this talk, we explore the possibilities and limits of using computation to analyze and control nonlinear PDE systems such as those which govern the magneto-hydrodynamics of a Tokamak. We begin the talk by showing how positive matrices can be used to parameterize many classes of Lyapunov functions for linear, nonlinear, delay-differential or PDE systems. We then study the implications of this result for stability and control of delayed and PDE systems. Next, we discuss the problem of MHD stability in plasma and present several PDE models. We then show how we can use our results to analyze and design real-time controllers for these models which use only point observations and sources of plasma current.