Jean Auriol (Saclay)

Title. Stabilization of integral difference equations and application to the stabilization of interconnected PDE systems

Abstract. Integral Delay Equations (IDEs) are a class of linear difference equations that incorporate both pointwise and distributed delays. These equations frequently arise in the modeling of engineering and biological systems where transport, communication, or measurement delays play a critical role. Prominent examples include sampled-data systems, population dynamics, and biomedical models such as epidemic spread. Notably, linear first-order hyperbolic Partial Differential Equations (PDEs), which are widely used to describe systems governed by balance laws, can also be reformulated as IDEs.

This presentation will focus on the design of stabilizing controllers for IDE systems, particularly in scenarios where the control input is affected by both pointwise and distributed delays. We will introduce auto-regressive controllers that leverage past values of both the control inputs and the system state. The correction terms will be determined by solving Fredholm integral equations, ensuring closed-loop stability. Additionally, we will illustrate how this controller architecture can be extended to stabilize interconnected PDE systems. Finally, we will examine the input-to-state stability properties of the resulting closed-loop systems.