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Title:
On integral input-to-state stability and equivalent notions for infinite-dimensional systems

Abstract:
Notions like input-to-state stability and integral input-to-state stability are well-known in finite-dimensional system theory. Recently, there has been growing interest in the study of these concepts for infinite-dimensional systems. The goal of this talk is to contribute towards this development. More precisely, we study the stability between the external input $u$ and the state $x$ of a linear system governed by the equation

$$\frac{d}{dt} x = Ax(t) + Bu(t), \quad x(0) = x_0,$$

where $A$ and $B$ are (typically unbounded) operators. Formally, stability notions can be interpreted as the boundedness of the input-to-state mapping

$$U \to X : x(\cdot) \to x(\tau), \quad \tau > 0,$$

where the topology (the norm) of the function space $U$ is determined by the particular stability notion, e.g., classical $L^p$-admissibility refers to $U = L^p$. We show that integral input-to-state stability can indeed be understood in this sense rigorously, drawing a connection to admissibility with respect to Orlicz spaces. In particular, we focus on stability with respect to functions in $L^p$. Furthermore, we study the relation between the different notions and compare them with (zero-class) $L^p$-admissibility.

This is joint work with B. Jacob (Wuppertal), R. Nabiullin (Wuppertal) and J.R. Partington (Leeds).