Author:

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Title:

Controllability results of linear difference equations

Abstract:

Difference equations are well known to be important tools in the analysis of hyperbolic systems of PDEs, since they provide a handy representation for some simplified dynamics. This talk considers the controllability of the difference equation $x(t) = \sum_{j=1}^{N} A_j x(t - L_j) + Bu(t)$ where $x(t) \in \mathbb{R}^d, u(t) \in \mathbb{R}^m$ is the control, $A_1, \dots, A_N$ and B are matrices of appropriate dimensions, and $L_1, \dots, L_N$ are positive delays. We present necessary and sufficient conditions on *relative* controllability, which consists on controlling the final state $x(T)$, in terms of some matrix coefficients computed from $A_1, \dots, A_N$ generalizing the usual Kalman controllability criterion. We also have results on exact and approximate L_2 controllability, which are complete in the case $N = d = 2, m = 1$. Our approach relies in an explicit formula for solutions, which has the advantage of providing criteria for all positive delays $L_1, \dots, L_N$, i.e., with no assumption of commensurability.