Another Approach to Bang-bang Properties of Minimal Time and Norm Controls for Some Evolution Systems

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Abstract

We present another way to approach the bang-bang properties of minimal time and norm control problems for some linear evolution systems. These systems are governed by C_0 semigroups with admissible control operators. First we study relationships between reachable subspaces and observable subspaces, these studies lead to two presentation theorems on the dual spaces of the observable spaces; then we derive the maximum principles for minimal norm controls; after that we use the equivalence of minimal norm controls and minimal time controls to get the maximum principle for minimal time controls, through the maximum principle of minimal norm controls; finally, we build up the bang-bang properties via the maximum principle. To get the maximum principle, we impose the assumption that the systems are null controllable from time intervals (This assumption can be indeed relaxed to a weaker one.) To derive the bang-bang properties, we impose the assumptions that the systems are both null controllable from time intervals and have the unique continuation from measurable sets in time.

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