DEPARTAMENTO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

Facultad de Ciencias MATEMÁTICAS

Instituto de Matemática Interdisciplinar

SEMINARIO DE ANÁLISIS MATEMÁTICO Y MATEMÁTICA APLICADA

Ruben Chenevat

INRAE - UMR MISTEA

About the Bang-Bang Principle for spatially-temporally regional affine dynamics

Abstract : The Bang-Bang Principle is a pillar of the theory of linear controlled systems (see [1, 2]. This results states that the attainability set at any time t coincides with the attainability set at the same time t using only extreme values for the control. It has consequences in terms of controllability and the nature of trajectories that join two points of the state space in minimal time.

We shall consider in this work spatially-temporally regional affine controlled systems, defined by a family of controlled affine systems over a partition of $\Omega \subset \mathbb{R}^+ \times \mathbb{R}^n$. Furthermore, we assume that the dynamics are continuous with respect to the state (but not necessarily differentiable), which prevents problems of uniqueness of solutions.

In these settings, we want to highlight with various examples that the Bang-Bang Principle does not hold globally. In particular, singular arcs might exist exactly at the loci of non-differentiability, ie at the boundaries of the regions of Ω. However, we show that there exist minimal time trajectories with extreme controls where the dynamics is differentiable. Let us underline that applying directly the Bang-Bang Principle for trajectories joining two points in a same region P_i does not guarantee that the trajectory with extreme controls remains in the same set P_i. This is precisely the matter investigated in the proof.

References

[1] Hermes, H. and La Salle, J.P. Functional Analysis and Time Optimal Control *John Wiley & sons, inc., Academic Press, New York*, 1969.

[2] Sonneborn, L. M. and Van Vleck, F. S. The Bang-Bang Principle for Linear Control Systems. *SIAM J. Control.*, 2(2) 151-159, 1964.

Organized by: Departamento de Análisis Matemático y Matemática Aplicada and Instituto de Matemática Interdisciplinar (IMI)

Date: Monday, June 17, 2024,12:00h
Place: Seminario Alberto Dou (Room 209)
Facultad de CC. Matemáticas, UCM