Worst-possible Fuller singularities of generic control-affine time-optimal systems

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ABSTRACT

It is known that the time-optimal trajectories of a control-affine system can have any kind of singularity. It is also known that the Fuller phenomenon (i.e., the accumulation of switching times) occurs generically for extremal trajectories of control-affine time-optimal systems if the dimension of the manifold is large enough and the control takes values in a polytope [1]. In this talk we consider the case where the control takes values in a m-dimensional ball. We present recent results stating that, for generic systems with $m = 1$ [2] or m even [3], the control u associated with an extremal trajectory is smooth out of a countable set of times. More precisely, there exists an integer K, only depending on m and on the dimension of the ambient manifold, such that the set of times where u is not smooth is made of isolated points, accumulations of isolated points, and so on up to K-th order iterated accumulations.

The talk is based on joint works with *Francesco Boarotto* and *Yacine Chitour*.

References

[1] Ivan A. K. Kupka: *The ubiquity of Fuller's phenomenon*, In Nonlinear controllability and optimal control, volume 133 of Monogr. Textbooks Pure Appl. Math., pp. 313–350, 1990.

[2] Francesco Boarotto and Mario Sigalotti: . *Time-optimal trajectories of generic control-affine systems have at worst iterated Fuller singularities*, Ann. Inst. H. Poincaré C Anal. Non Linéaire Vol. 36 (2), pp. 327–346, 2019.

[3] Francesco Boarotto, Yacine Chitour, and Mario Sigalotti: *Fuller singularities for generic control-affine systems with an even number of controls*, SIAM J. Control Optim. Vol. 58 (2), pp. 1207–1228, 2020.