Seminario de Álgebra, Geometría algebraica y Singularidades
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Realization of Poincaré-Reeb graphs by real algebraic domains

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In this talk we extend a previous method of study of non-convexity of topological disks bounded by a smooth, compact, connected component of a real algebraic plane curve near a strict local minimum of a bivariate polynomial function to the more general context of *real algebraic domains*. By definition, the latter are closed topological subsurfaces of a real affine plane, whose boundary consists of a finite number of disjoint smooth connected components of real algebraic plane curves.

When the domain is compact, the collapsing of maximal vertical segments contained in it yields a finite planar graph which is not necessarily a tree, called the *Poincaré–Reeb graph* of the domain, relative to the vertical direction. Our main result is a positive answer in the generic case to the following question: *given a transversal graph in a vertical plane, is it possible to find an algebraic domain whose Poincaré–Reeb graph is isomorphic to it?*

We also explain how to construct non-compact algebraic domains realizing some of the non-compact transversal graphs.

Moreover, in order to be able to use our construction of Poincaré–Reeb graphs for the study of more general subsets of affine planes than algebraic domains, we give a purely topological description of the setting in which the construction may be applied. Namely, we define the notion of *domain of finite type* inside a *vertical plane*.

This is a joint work with Arnaud Bodin and Patrick Popescu-Pampu (Université de Lille, France).

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