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Tautological Control Systems

A framework for geometric control theory is presented. The objectives of the framework are: (1) to be independent of any parameterisation of controls, cf. coordinate-invariance in differential geometry; (2) to be able to seamlessly incorporate real analytic system models; (3) to permit general control sets; (4) to incorporate locally defined data. The putting in place of these objectives is intended to ensure that models do not obstruct any understanding of their fundamental structural properties, e.g., controllability, stabilisability, optimality. The meaning of each of these objectives is explained, and a framework achieving them is presented. The framework requires suitable topologies for spaces of vector fields, particularly real analytic vector fields. The use of topologies allows a unified treatment of different regularity classes: finitely differentiable, Lipschitz, smooth, real analytic. This, per se, provides some interesting results concerning the flows of vector fields depending measurably on time.