Quadratic nonholonomic constraints

Witold Respondek

A quadratic nonholonomic constraint on a manifold X is the zero set of a polynomial of degree two in velocities thus defining a quadric in each fibre of the tangent bundle TX. We will study the geometry of quadratic nonholonomic constraints, their characterisations, and their classification by attaching to them their prolongations: a nonlinear control system (first prolongation) and a control-affine system (second prolongation). If X is a surface, that is, for $n = 2$, we give an explicit characterisation of quadratic nonholonomic constraints and propose a classification by providing normal forms for elliptic, hyperbolic, and parabolic constraints. For an arbitrary n we study parabolic nonholonomic constraints. We also describe the cases, when a nonholonomic quadratic constraint is uniquely determined via symmetries of the control-affine system defined by the second prolongation of the constraint. The talk is based on joint research with Timothée Schmoderer (Polytech Orléans, France).

References

[1] T. Schmoderer and W. Respondek, *Null-forms of conic systems are determined by their symmetries*, Systems and Control Letters, vol. 170, 2022.

[2] T. Schmoderer and W. Respondek, *Conic nonholonomic constraints on surfaces and control systems*, J. Dynamical and Control Systems, 29, 2023.

First Author:	Witold Respondek
Affiliation:	*Institute of Automatic Control, Lodz University of Technology*
	90-537, Poland
	Emeritus Professor at Normandie Université, INSA de Rouen
	76800, France
e-mail:	`witold.respondek@insa-rouen.fr`