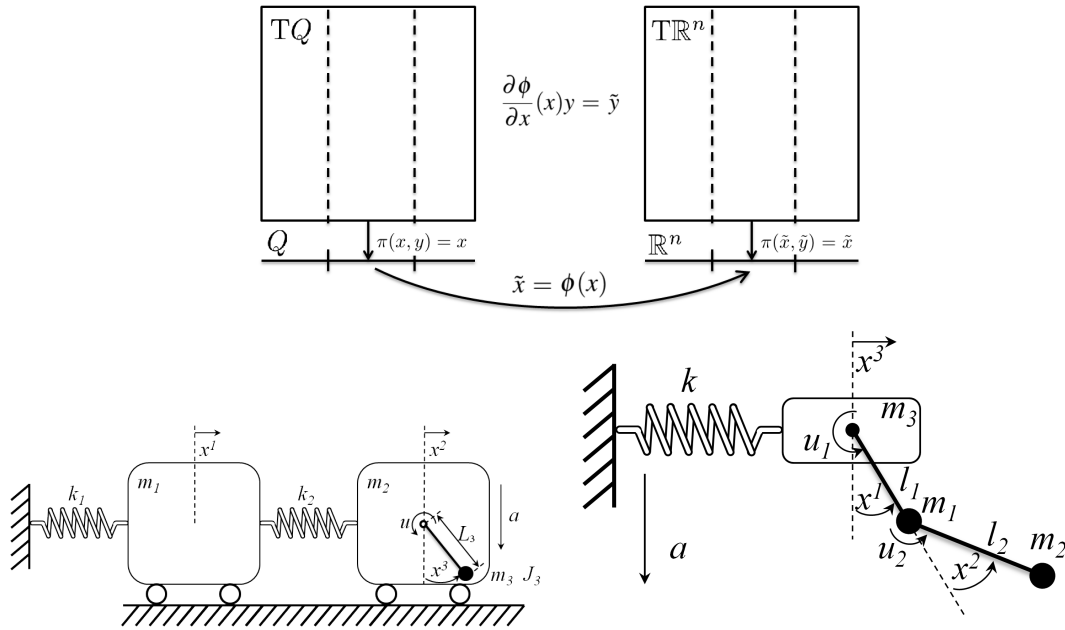# Linearization of Mechanical Control Systems

Marcin Nowicki, Witold Respondek

For mechanical control systems we discuss the problem of linearization that preserves the mechanical structure of the system in two variants: mechanical state-space linearization and mechanical feedback linearization. We formulate necessary and sufficient conditions using objects on the configuration space Q only, despite the fact that the state–space of mechanical system is the tangent bundle TQ. In contrast to the linearization of general nonlinear systems, mechanical linearization can be performed for both controllable and noncontrollable systems. In our study, we utilized some geometric tools, such as Lie brackets, distributions, covariant derivatives, and the Riemann curvature tensor that have an immediate mechanical interpretation. We illustrate our results by examples of linearizable mechanical systems.

References

[1] M. Nowicki, W. Respondek, *Mechanical linearization of mechanical control systems without controllability assumption*, Automatica, vol. 155, 111098, (2023)

[2] M. Nowicki, W. Respondek, *Mechanical feedback linearization of single-input mechanical control systems*, IEEE Trans. Autom. Control, vol. 68, no. 12, pp. 7966-7973, (2023)

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