Routh reduction for hybrid forced systems

Asier López-Gordón[1]

Instituto de Ciencias Matemáticas (CSIC-UAM-UC3M-UCM)
Calle Nicolás Cabrera, 13-15, Campus Cantoblanco, UAM, 28049 Madrid, Spain
✉ asier.lopez.@icmat.es

🌐 www.alopezgordon.xyz

Abstract

Many physical systems require an external force, besides the Hamiltonian or Lagrangian function, to describe their dynamics. Moreover, external forces arise after performing a process of reduction in a nonholonomic system with symmetries. On the other hand, hybrid systems (i.e., systems with continuous-time and discrete-time dynamics) have been employed to model several physical systems of interest in engineering, such as bipedal robots and multiple UAV systems.

In this talk, I will discuss the symmetry reduction of simple hybrid mechanical systems via Routh reduction. The main difference with the reduction of continuous systems is that, in general, the value of the momentum map will change in the impacts (when the dynamics is discrete). This will lead to the existence of a reduced space for each interval of time between to subsequent impacts. Additionally, the reduction of forced systems requires characterizing the (sub)group of symmetries which preserves both the Lagrangian (or Hamiltonian) function and the external force.

References

[1] Leonardo J. Colombo, Manuel de León, María Emma Eyrea Irazú, Asier López-Gordón, *"Symplectic and Cosymplectic Reduction for simple hybrid forced mechanical systems with symmetries"* (2022), arXiv:2112.02573 [eess.SY]

[1] Joint work with Leonardo J. Colombo (CAR-CSIC), María Emma Eyrea Irazú (CONICET-CMaLP) and Manuel de León (ICMAT-CSIC)