



UNIVERSITÀ  
DI TRENTO  
Dipartimento di  
Matematica

# DOTTORATO



CYCLE 35th  
ORAL DEFENCE OF THE PHD THESIS

**Wednesday 5 July 2023 – at 3.00 pm**

Department of Mathematics  
Seminar Room 1

The event will take place in presence and online through the ZOOM platform.  
To get the access codes please contact the secretary office

## Paolo Eugenio Petit Valdes Villarreal

PhD Student in Mathematics

### Geometry and Dynamics of Nonholonomic Affine Mechanical Systems

**Abstract:**

In this Thesis we study two types of mechanical nonholonomic systems, namely systems with linear constraints and lagrangian with a linear term in the velocities, and nonholonomic systems with affine constraints and lagrangian without a linear term in the velocities. For the former type of systems we construct an almost-Poisson bracket using elements related to a riemannian metric induced by the kinetic energy, and we show that under certain conditions gauge momenta exist. For the latter type of systems, we focus on the ones possessing a Noether symmetry. To everyone of these systems we associate an equivalent system of the former type, and we exhibit the procedure to relate them and their gauge momentum. As a test case for the theory, we analyze the system of a heavy ball rolling without slipping on a rotating surface of revolution: we elucidate that also in this framework the so-called Routh integrals are related to symmetries, we give conditions for boundedness of the motions. In the particular case the surface of revolution is an inverted cone we characterize the qualitative behavior of the motions.

**Supervisor:** Nicola Sansonetto

**CONTATTI**

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