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MODEL-BASED OPTIMIZATION FOR ROBOTICS

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Justin Carpentier

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Progress and prospects in optimisation for learning and control in robotics

Over the past decades, optimisation has become a core component of robotics. It provides a consistent and flexible way to formalize and solve complex problems in robotics, ranging from simulation to learning and control. While writing optimisation solvers was initially the job of specialists in optimisation, the past few years have seen the emergence of new solvers developed by roboticists, and for robotics. This paradigm change corresponds to a turning point in the community, justified by the absence of off-the-shelf solvers capable of precisely and efficiently handling the specific features of robotic problems.

In this talk, I will present a general overview of our recent contributions to optimisation for robotics. In the first part, I will first review contributions around the development of generic and efficient solvers to tackle a wide variety of optimisation problems arising in robotics, ranging from standard quadratic problems (QPs) to nonlinear problems (NLPs) and trajectory optimisation problems (TO). The second part will deal with physical simulation. I will highlight recent progress to improve simulator accuracy and efficiency and draw some perspectives about differentiating physics, which is by nature non-smooth.

Biography:

Justin Carpentier is a permanent researcher between Inria and the Computer Science department of École Normale Supérieure in Paris, where he leads the robotics activity inside the Willow research group. Justin's research lies at the interface Perception, Learning, Optimisation and Control for Robotics. Justin is also the main developer and contributor of several robotics software, among them Pinocchio and ProxSuite.

In September 2018, Justin joined the Willow research group as a postdoctoral fellow. From 2014 to 2018, he was a PhD student and postdoctoral researcher inside the Gepetto research group at LAAS-CNRS in Toulouse. At this time, his research was devoted to the understanding of the computational foundations of anthropomorphic locomotion, with contributions in both human motion analysis and legged locomotion. In 2014, he was a visiting student inside the Optimization in Robotics and Biomechanics group with Katja Mombaur at the University of Heidelberg.