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2023-2024 TC Seminar Series

**Zoom:** <https://columbiauniversity.zoom.us/j/91247893326?pwd=L2JWU21aQzc4cU1ZQkIEb0QrWGQvdz09>

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**Dr. Alessandro Saccon**  
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*Impact-Aware Manipulation: Exploiting Intentional Collisions to Speed Up Task Execution*

**Abstract:**

Traditionally, robots fear collisions. Contact is either avoided at all cost or established at vanishing speed. There are several reasons for this to happen: an important one is the lack of suitable hardware. Robot physical components, especially joints and transmissions, need to be made resilient to collisions by design in order not to get damaged. However, recent hardware developments, including those in the area of soft robotics, are rapidly changing the hardware landscape. Modern robot hardware is starting to showcase the possibility of sustaining and thus exploiting impacts. A clear and well-known example is Boston Dynamics' humanoid robot ATLAS, performing acrobatic moves such as somersaults and jumps. The availability of impact-resilient hardware opens up possibilities to develop and validate new impact-aware manipulation and locomotion strategies. Strategies where contact between the robot and its surrounding environment is intentionally established at desired non-negligible speed to achieve user-defined motion objectives. The exploitation of intentional impacts is particularly appealing for reducing a task's execution time. But also for reducing energy consumption due to the lack of fast decelerations and acceleration traditionally required to stop the robot at contact time and to make it move again after contact has been established. In this talk, I will provide an overview of the research carried out at the TU/e on this fascinating new field of research, specifically focusing on impact-aware control and post-impact velocity prediction aspects.

**Biography:**

Alessandro Saccon is an Associate Professor in Nonlinear Control and Robotics at the Mechanical Engineering Department of the Eindhoven University of Technology (TU/e). His areas of expertise include nonlinear control and estimation, robotics, numerical optimal control and optimization, multi-body dynamics, geometric mechanics, and computer vision. Alessandro's research interests are focused on modeling, analysis, and control of complex and highly dynamical robotic and mechatronic systems. His current research efforts are directed toward the development and validation of innovative control strategies for robotic systems with multiple intermittent dynamic contacts, with application in the field of dynamic robot manipulation and locomotion. Within this context, he is coordinating the Horizon 2020 EU project I.A.M. (<https://www.i-am-project.eu/>), focusing on impact-aware manipulation for logistics applications. He is an associate editor of the IEEE Transactions on Robotics (T-RO) and guest editor for the IEEE T-RO Special Section on Impact-Aware Robotics.