

**Master's Thesis Defense Presentation  
Department of Mechanical Engineering**

**Tuesday, November 23, 2021**

**9:00 AM**

**Zoom Video Conference**

**Optimal Control of the AC75 Sailboat for the  
America's Cup Race**

**Renato J. Rodriguez Nunez**

**Mechanical Engineering**

**Committee:**

Dr. Damoon Soudbakhsh, Dr. Jim Chen,  
Dr. Phillip Dames, Department of Mechanical Engineering

**Abstract:**

This research focuses on the development of optimal sailing maneuvers for a nonlinear, high-dimensional, and highly unstable AC75 foiling sailboat competing in America's Cup, the most prestigious sailboat racing competition in the world. These optimal maneuvers serve as performance benchmarks and provide insightful information about the underlying dynamics of this complex system. They were developed via the exploration of out-of-the-box solutions through controls and optimization. We use a high-fidelity sailboat simulator for data generation and data-driven methods for optimization of the maneuvers including close-hauled, tacking, and takeoff. The close-hauled and tacking maneuvers were optimized to achieve maximum Velocity Made Good (VMG) and minimum loss of VMG, respectively. The takeoff maneuver was optimized for maximum VMG and minimum time for the boat's transitions from displacement mode to foiling mode. The optimal solutions are subject to physical constraints and operational constraints enforced by the humans (sailors) in the loop. Additionally, an in-depth analysis is performed to discern optimal trends in the parameter space. This provides interpretable information that can help guide the sailor's decisions during a race.

**Zoom Details**

Renato Rodriguez Nunez is inviting you to a scheduled Zoom meeting.

Topic: Thesis Defense – Renato Rodriguez Nunez

Time: Nov. 23<sup>rd</sup>, 2021, 9:00 AM Eastern Time  
(US and Canada)

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