

CDC 2020 Workshop: Real time NMPC – From Fundamentals to Industrial Applications

Thivaharan Albin, Embotech AG

Stefano Longo, Embotech AG

Craig Buhr, MathWorks Inc.

Objectives:

In this workshop we would like to give an overview on Nonlinear Model Predictive Control development concentrating on the industrial perspective. At the beginning an overview on the topic of real-time Nonlinear MPC is given. Based on this, challenges are outlined for developing NMPC algorithms for serial deployment, such as numerical solution algorithms. Along with that some best practices and state-of-the-art tools are presented that facilitate the design. Finally, several success stories for application of Nonlinear MPC to real-world systems are given. They range from autonomous driving to the field of robotics. The presenters from Embotech and MathWorks will highlight some use cases and experience from their industrial work.

The workshop is planned as an 8-hour workshop (4hrs Sat. + 4hrs. Sun). Pre-recorded videos are shown which are followed by Q&A sessions. Additionally, programming examples are distributed, such that participants are able to get hands-on experience.

Saturday, 12th of December, 1 pm – 5pm (UTC), Event Hall 2 on JVCC:

1 pm – 2 pm	Overview – What is MPC and when to use it	T. Albin (Embotech AG)
2 pm – 3pm	Numerical solutions algorithms for practical applications	J. Ferreau (Embotech AG)
3 pm – 3.15 pm	break	
3.15 pm – 5 pm	MPC design workflow	C. Buhr (MathWorks Inc.)

Sunday, 13th of December, 1 pm – 5pm (UTC), Event Hall 2 on JVCC:

1 pm – 1.45 pm	Model-based rapid prototyping workflow	K. Lekkas & T. Albin (Embotech AG)
1.45 pm – 2.45 pm	Motion Planning Example	S. Longo & V. Hauser (Embotech AG)
2.45 pm – 3.00 pm	Break	
3.00 pm – 4.15 pm	Motion Tracking // Highway Lane Change Example	C. Buhr (MathWorks Inc.)
4.15 pm – 5 pm	Tips and Tricks	C. Buhr (MathWorks Inc.)

Organizers' short bio and contact information:

Thivaharan Albin works for Embotech AG as Head of Industrial Automation Solutions. There he is bringing NMPC applications from the field of Industrial Automation, e.g. Laser Cutting machines, into serial deployment. E-Mail address: albin@embotech.com

Stefano Longo is the head of Automotive at Embotech AG. During his previous career as an academic, he has worked on automotive applications of real time nonlinear MPC. E-Mail address: longo@embotech.com

Craig Buhr is the development manager for the Control Design group at MathWorks, whose focus is developing tools for the design and analysis of control systems and reinforcement learning. He joined MathWorks in 2003 as a Senior Developer for the Controls and Identification products. He received his Ph.D. in Mechanical Engineering from Purdue University. E-Mail address: cbuhr@mathworks.com