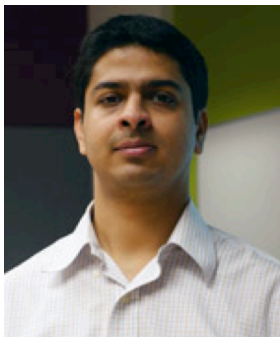# Evaluating Model Predictive Control for Vehicle Powertrain Thermal Management Applications

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**Ford Motor Company**
**Controls Research and Avanced Engineering**

## Friday, February 9, 2018
### 3:30 – 4:30 pm • 1500 EECS

**ABSTRACT:** The Control of vehicle powertrain thermal management systems is becoming more challenging as the number of components is growing, and as a result, advanced control methods are being investigated. An organized controls development process is necessary to allow comparison of multiple configurations to select the best option. Model predictive control (MPC) is particularly interesting in this application because it provides a suitable framework to manage actuator and temperature constraints, and can potentially leverage preview information if available in the future. The development of an MPC controller from conception to controller deployment in a vehicle will be discussed in this seminar. Various challenges were faced related to robustness, system nonlinearities and chronometric limitations. Each of these challenges was addressed through enhancement of the MPC formulation. Concepts related to economic MPC, robust MPC and mixed integer programming were evaluated with varied levels of success and failures. The aim is to provide a flavor of the various developmental steps that need to be addressed for evaluation of MPC as a potential control solution for implementation in an automotive industry setting.

**BIO:** Amey Karnik is a Technical Expert in Controls Research and Advanced Engineering and his research focus includes application of advanced control methods for complex systems. He joined Ford Motor Company in 2007 and worked on various aspects of engine air-path management for the Eco Boost engines. His recent work includes application of advanced control methods to powertrain thermal systems. He is also a visiting lecturer at the University of Michigan, where he teaches courses related to modeling and system analysis. Amey graduated with an undergraduate degree in mechanical engineering from the University of Mumbai, India, in 2002, and the M.S. and Ph.D. degrees from the University of Michigan, Ann Arbor, in 2004 and 2007, respectively

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