Control Analysis for High BMEP Gasoline Engines

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Sponsor: Cummins

Project Description

- Performing a control architecture design and analysis for the medium duty stoichiometric direct injection gasoline engine which will be used in the EREV truck.
- This project focuses on advanced control systems development to improve engine efficiency and transient performances.

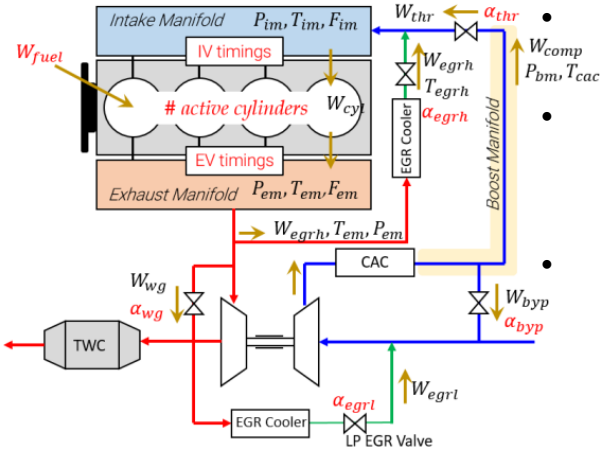
Approach

- Identifying the operation conditions for the medium duty gasoline engine used in EREV trucks.
- Reviewing literature of challenges in gasoline engine design and advanced strategies, like VVT and EGR.
- Reviewing literature of optimal sensor selection and placement methods and testing them on simple systems.
- Control-oriented engine modeling and validation with GT-Power.
- General procedures development for optimal selection of actuators and sensors based on the control-oriented engine model and experimental data.

Discussion

- Engine knock is a problematic issue for SI engines.
- EGR fraction control is critical for engine transient performances.
- The choice and location of air handling sensors on the engine to accurately track the gas components is important for ensuring stoichiometric engine operation.

Results



- Understood EGR operation ranges and corresponding engine performances.
- Nonlinear control-oriented model is being developing and testing for actuator responses.
- Reviewing literatures for optimal sensor placement methods and testing them on simple mass-damper systems.

Advanced control system design and sensor placement are important for improving high BMEP gasoline engine's fuel efficiency and transient performances.