BIOGRAPHICAL SKETCH

Kuo Yang was born in Qinhuangdao, Hebei, China, on March 20, 1991. He graduated from Nanjing University of Science and Technology in June 2014 with a Bachelor of Engineering in Automotive Engineering. He graduated from Politecnico di Torino in December 2016 with a Master of Science in Automotive Engineering. He began a doctoral degree program in engineering in Tennessee Technological University in August 2017.

EDUCATION

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The Department of

Mechanical Engineering

Announces the Dissertation Defense of

Kuo Yang

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Zoom Link: Meeting ID: 813 0632 9164 Passcode: 612086

FIELD OF STUDY

Mechanical Engineering

DISSERTATION TOPIC

Modelling and Control of Vehicle Powertrain System

EXAMINING COMMITTEE

Dr. Pingen Chen (Chairperson)

Dr. Stephen Canfield

Dr. Jie Cui

Dr. Ghadir Radman

Dr. Dale Wilson

ABSTRACT

The objective of the studies in this dissertation are to take use of nonlinear optimization and control methodologies to improve the energy efficiency and reduce the emissions of the powertrains systematically, and yet maintain low operation cost for end users. The studies of the dissertation can be divided into three sections. In the first section, the study covered the modeling of diesel engine and model-based controls of the integrated system of diesel engine and active Selective Catalytic Reduction (SCR) system. The turbocharged diesel engine equipped with Exhaust Gas Recirculation (EGR) and Variable Geometry Turbine (VGT) is modeled to estimate the fuel consumption and engine-out NOx emissions. The model is calibrated and validated by collected data from an experimental platform of turbocharged V8 engine. The Brake Specific Fuel Consumption (BSFC) and NOx emissions of the diesel engine is optimized systematically with the actuations of EGR and VGT. The SCR system with the new system configuration of raw exhaust bypass valve is modeled and controlled by two coordinated Sliding Mode Controllers (SMC) to accelerate the ammonia storage profile transition. The integrated system of diesel engine and SCR system is controlled by a backstepping-based, real-time framework with the control of the start of fuel injection timing (SOI) and the ammonia injection rate of SCR system to optimize the fuel efficiency and tailpipe NOx emissions. The second section covers the model-based dither and predictive control of the integrated system of gasoline engine and Three-Way Catalytic Converter (TWC) system. In the last section, the Direct Current Fast Charging (DCFC) scheduling of the Electric Vehicle (EV) is globally optimized by Dynamic Programming (DP) to reduce the total charging cost.