Project proposal template
Graduate School studentships
March 2015

Project title	An intelligent system for diesel engine cylinder output equalisation
First Supervisor	Professor — M. Necip Sahinkaya
Second Supervisor	Yahya Zweiri
School	Mechanical and Automotive Engineering
Other member of supervisory team (no more than three KU supervisors in total)	Robert Rayner
Specific requirements beyond 2:1 degree	

Project summary

(max 4,000 characters)

Multi-cylinder internal combustion engines exhibit imbalances in power output between cylinders. For diesel engines, inter-cylinder power variations of 5-20%, expressed as indicated torque values, have been reported. Inter-cylinder output variation results in uneven acceleration of the crankshaft during each rotation causing vibration, accelerated wear and possibly early failure of engine components. Secondary effects relate to increased variance in combustion and exhaust gas temperature and pressure. Within this context, and in the absence of per-cylinder fuelling mass and timing control, total engine output, emissions and fuel economy metrics may be significantly compromised.

Several manufacturers have introduced engine control software calibration settings varying the mass and timing of fuel delivered to individual cylinders, under prescribed operating conditions. To date, however, such approaches have been based on measured data acquired from a limited sample of engines tested on dynamometers. The result has been an often simplistic, *one-size-fits-all* solution unable to account for inter-engine and environmental condition variability.

Alternative approaches have relied on inter-cylinder pressure sensors and custom software. Such solutions are able to quickly and accurately characterise the combustion event, identifying inter-cylinder imbalances and allowing mitigation by tailoring fuel delivery. High production and installation costs, however, have limited widespread use of the technology.

The proposed research study shall address the problem of inter-cylinder output imbalance through the development of an electronically-controlled fuel delivery system. The system will adaptively reduce inter-cylinder output variation without requiring hardware modifications, by modulating fuel supply in real time, whilst measurably lowering emissions and improving fuel economy, total engine reliability and output.

The research project will be carried in collaboration with **Jaguar Land Rover**.