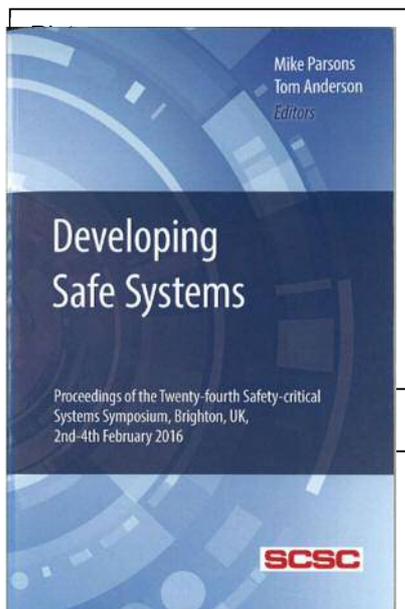


Research Project

FUNCTIONAL MONITORING SOFTWARE IN HYBRID AND ELECTRIC VEHICLES



Motivation

Modern road vehicles almost exclusively use drive-by-wire to control acceleration. This requires functional software within the ECU to interpret the pedal position to a torque request. Should this software malfunction, a potentially unsafe situation could arise, thus a second piece of robust software monitors the functional software for errors or unsafe requests. Methods for developing monitoring software on conventional powertrains are well established, but are expensive when used on hybrid and electric variants. Therefore, new methods are being explored.

Adaptive Monitor

With the help of Jaguar Land Rover, an adaptive monitor is in development, with initial results showing much promise. It is able to mimic the adaptive nature a human driver has to faults or changes in the vehicle. Some noise factors therefore do not need to be accounted for, making design and verification of monitoring software less expensive. The concept has been published and presented at the Safety-critical Systems Symposium in Feb 2016 (middle).

Observers

Observers, which include Kalman Filters, are well established in fault detection within many industries (particularly aerospace), but primarily with hardware fault diagnosis. Observers are currently being evaluated for use in detecting software faults.

Future work

An investigation into Principle Component Analysis is planned for as an alternative research avenue. So far, all work has been done in simulation, so future research efforts are aimed at development of monitoring software concepts for real vehicle testing (bottom). Additional research will be conducted with the adaptive monitor on how behaviour could change based on context, much like a human driver.

Researchers:
Frederik Botes

Academic staff:
Dr Andrew Hillis
Dr Sam Akehurst
Dr Marina de Vos