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Implementation of Conceptual Real-Time Embedded Functional Design via Drive-By-Wire ECU Development

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Abstract : Design concepts of real-time embedded system can be realized initially by introducing novel design approaches. In this literature, model based design approach and in-the-loop testing were employed early in the conceptual and preliminary phase to formulate design requirements and perform quick real-time verification. The design and analysis methodology includes simulation analysis, model based testing, and in-the-loop testing. The design of conceptual drive-by-wire, or DBW, algorithm for electronic control unit, or ECU, was presented to demonstrate the conceptual design process, analysis, and functionality evaluation. The concepts of DBW ECU function can be implemented in the vehicle system to improve electric vehicle, or EV, conversion drivability. However, within a new development process, conceptual ECU functions and parameters are needed to be evaluated. As a result, the testing system was employed to support conceptual DBW ECU functions evaluation. For the current setup, the system components were consisted of actual DBW ECU hardware, electric vehicle models, and control area network or CAN protocol. The vehicle models and CAN bus interface were both implemented as real-time applications where ECU and CAN protocol functionality were verified according to the design requirements. The proposed system could potentially benefit in performing rapid real-time analysis of design parameters for conceptual system or software algorithm development.

Keywords : drive-by-wire ECU, in-the-loop testing, model-based design, real-time embedded system
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