

On the Design of Electronic Control Units for the Safety-Critical Vehicle Applications

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Abstract : This paper suggests a design methodology for the hardware and software of the Electronic Control Unit (ECU) of safety-critical vehicle applications such as braking and steering. The architecture of the hardware is a high integrity system such that it incorporates a high performance 32-bit CPU and a separate Peripheral Control-Processor (PCP) together with an external watchdog CPU. Communication between the main CPU and the PCP is executed via a common area of RAM and events on either processor which are invoked by interrupts. Safety-related software is also implemented to provide a reliable, self-testing computing environment for safety critical and high integrity applications. The validity of the design approach is shown by using the Hardware-in-the-Loop Simulation (HILS) for Electric Power Steering (EPS) systems which consists of the EPS mechanism, the designed ECU, and monitoring tools.

Keywords : electronic control unit, electric power steering, functional safety, hardware-in-the-loop simulation

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