

## Evaluation of a Method for the Virtual Design of a Software-based Approach for Electronic Fuse Protection in Automotive Applications

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**Abstract :** New driving functionalities like highly automated driving have a major impact on the electrics/electronics architecture of future vehicles and inevitably lead to higher safety requirements. Partly due to these increased requirements, the vehicle industry is increasingly looking at semiconductor switches as an alternative to conventional melting fuses. The protective functionality of semiconductor switches can be implemented in hardware as well as in software. A current approach discussed in science and industry is the implementation of a model of the protected low voltage power cable on a microcontroller to calculate its temperature. Here, the information regarding the current is provided by the continuous current measurement of the semiconductor switch. The signal to open the semiconductor switch is provided by the microcontroller when a previously defined limit for the temperature of the low voltage power cable is exceeded. A setup for the testing of the described principle for electronic fuse protection of a low voltage power cable is built and successfully validated with experiments afterwards. Here, the evaluation criterion is the deviation of the measured temperature of the low voltage power cable from the specified limit temperature when the semiconductor switch is opened. The analysis is carried out with an assumed ambient temperature as well as with a measured ambient temperature. Subsequently, the experimentally performed investigations are simulated in a virtual environment. The explicit focus is on the simulation of the behavior of the microcontroller with an implemented model of a low voltage power cable in a real-time environment. Subsequently, the generated results are compared with those of the experiments. Based on this, the completely virtual design of the described approach is assumed to be valid.

**Keywords :** automotive wire harness, electronic fuse protection, low voltage power cable, semiconductor-based fuses, software-based validation

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