Evaluating a New Time-Triggered CAN FD Protocol with Periodic Messages

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Abstract

Controller Area Network (CAN) is a real-time communication bus widely accepted and used in automotive and industrial applications. CAN provides robust and low-cost solutions for real-time control systems. Its priority based bit-wise arbitration mechanism ensures that the highest priority messages have fast access to the bus. However, the lower priority messages may experience long message delays under heavy bus load and low transmission bit-rate conditions. In CAN, message transmission speeds are limited at certain bus lengths. CAN with Flexible Data-rate (CAN FD) offers a solution by applying higher transmission bit-rates for the dataphase of the message frame. However, CAN FD uses the same medium access method as CAN. This may cause CAN FD to inherit the features of CAN causing long delays for the lower priority messages. This study investigates the application of Time-Triggered CAN with Flexible Data-rate (TTCAN FD) with periodic messages. Combining the time-triggered feature of TTCAN with fast CAN FD provides an exceptional opportunity for periodic messages to transmit faster without arbitration, which is not possible with CAN or CAN FD. In order to evaluate the performance improvements, the system models with the PSA (Peugeot Societe Anonyme)
message set, comprised of periodic messages, have been developed and simulated. This study also introduces a new analysis method called the performance ratio, which provides a quantitative performance comparison opportunity. The results show that the investigated new versions of TTCAN FD protocol models provide considerable performance improvements with deterministic immediate access for periodic message sets, and more comprehensive analysis is achieved with the introduced performance ratio method.

References

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Index Terms

Computer Science      Networks

Keywords

Message Scheduling, Controller Area Network, TDMA