New Products

Development of Waveform Quality Analysis Method in High-speed, In-vehicle LAN

Fujikura has developed a new analysis method enabling highly accurate assessment of waveform quality in high-speed, in-vehicle LAN. This has resulted in reductions in the number of prototypes to be made and lead time for designing wiring for a high-speed, in-vehicle LAN.

With the advancement of driving assistance technology, communication speed needed for in-vehicle electronic components is on increase every year. The protocol of controller area network with flexible data rate (CAN FD®), of which communication speed has been increased four- fold to 2 Mbps, is just beginning to be adopted in addition to that of 500 kbps controller area network (CAN®), which is currently the mainstream.

The CAN FD protocol as well as the CAN protocol are used to construct an in-vehicle LAN (Fig.1) by connecting multiple electronic control units (ECUs) with twisted pair cables (TP cables). As shown in Fig. 2, since the communication speed becomes 4 times higher, the time for 1 bit is shortened to a quarter. The requirements for CAN FD waveform quality are severer than those for CAN. The waveform quality of CAN FD largely depends on the properties of ECUs, TP cables and connectors, the location of junctions of TP cables as well as the paths of the wiring harnesses (WHs) that are assembled into vehicles. Therefore, it is necessary to evaluate the waveform quality in a short time at the WH wiring design stage.

To cope with this challenge, we have established high-accuracy waveform quality analysis method. This was enabled by highly accurately modeling the components based on property values using very high-speed integrated circuit hardware description language-analog mixed signal (VHDL-AMS), which is a standard language in the model-based development industry (Fig. 3).

The coefficient of correlation between analyzed and measured waveforms is 0.9 or higher (Fig. 4) and has allowed designing WH that secures a good waveform quality in a short time when ECUs are added or the locations are changed.

Furthermore, this analysis method is compatible with the protocol of the next-generation controller area network signal improvement capability (CAN SIC) that has a communication speed of 5 Mbps in addition to the CAN FD protocol.

While the advancement of driving assistance and autonomous driving technologies accelerates the communication speed in an in-vehicle LAN and makes the network more complex, we will promote the development that supports the advancement.

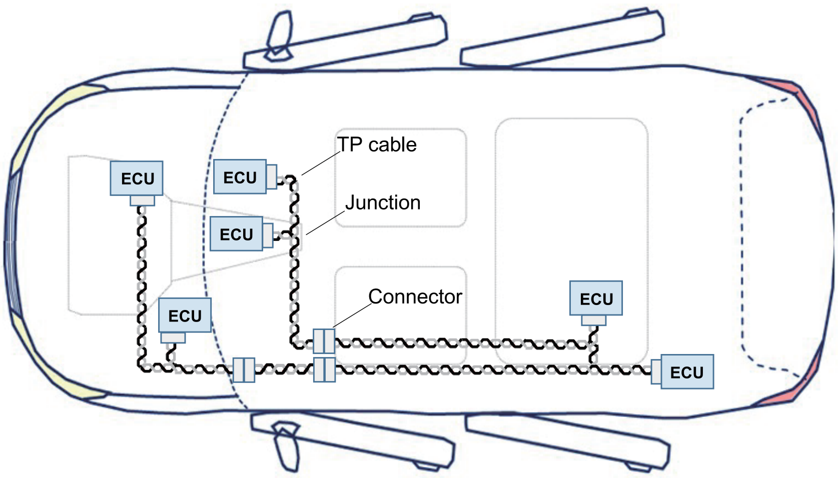

Fig.1. Example of wiring in in-vehicle LAN using CAN FD.

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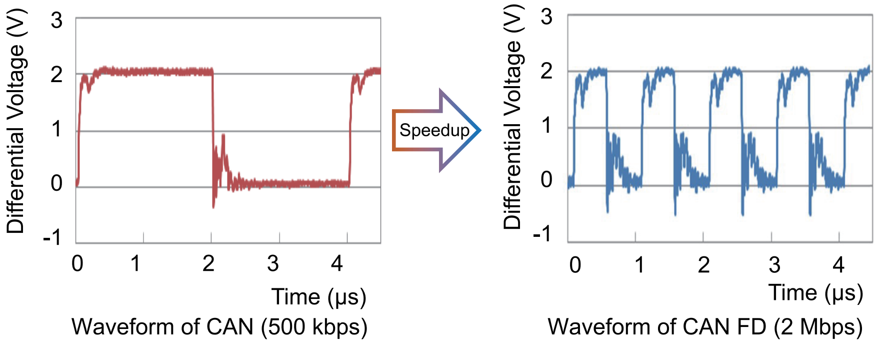

Fig.2. Comparison of waveforms between CAN and CAN FD.

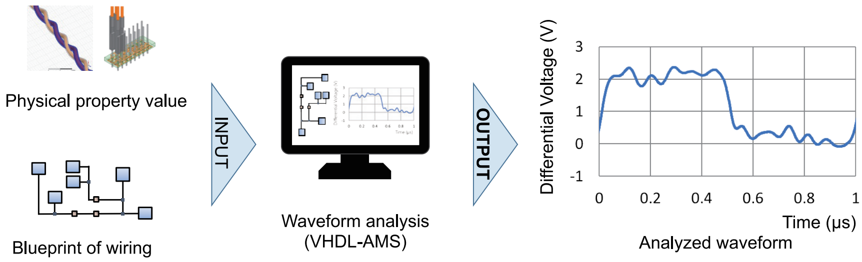

Fig.3. Analysis of waveform quality.

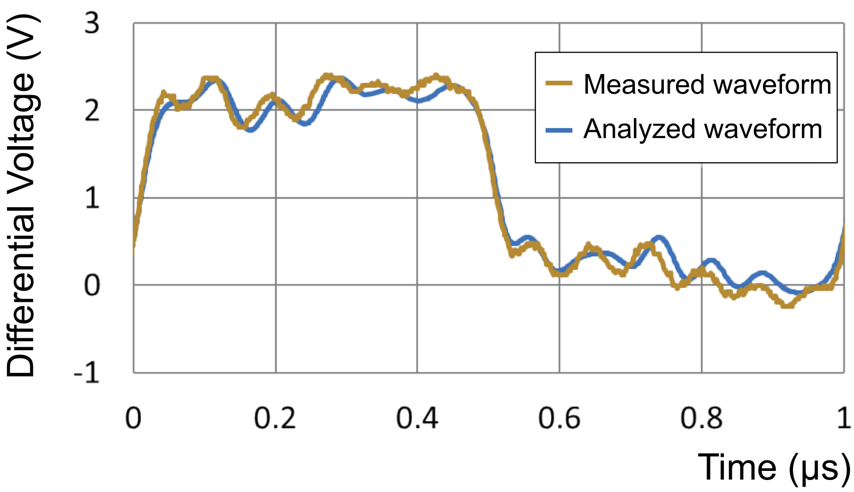

Fig.4. Comparison of analyzed waveform and measured waveform.

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