

Construction of Net Topologies for FlexRay

Nicht zur Verwendung in Intranet- und Internet-Angeboten sowie elektronischen Verteilern

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The complexity of vehicle networks has increased continuously and the trend to realize even more functions, which can not be handled without a corresponding extensive communication, is even going on. This situation is also getting harder by often changes of the functions and the integration in existing networks.

To cope with these demands robust standards on the software as well as on the hardware-level are needed, which gives the possibility to build up and change a reliable network in a short time.

Unfortunately in the past this aspect has gathered not very much attention. The result is that nearly every car-manufacturer created its own network topology, which fits the special needs of a specific car and is also only tested in this environment. A forecast how the network will behave, when modifications are done is very difficult and the testing of such a network is very time intensive.

To get a higher reliability of future cars, we have to do new steps in case of the network design. Actually most car manufacturer's build up the needed network for a new car as laboratory assembly. With this they examine the reliability of the network. Unfortunately this view allows not the consideration of the unbelievable number of variations of the different influences.

This would lead to such a high number of test cases that cannot be handled. Further on influences like tolerances of the electronic components can nearly not be reproduced in the laboratory.

Because of this constellation the investigation of the network-robustness of the laboratory assembly leads to a misleading „ok“, although important aspects cannot be examined sufficiently. That this may lead to problems in the field has not to be mentioned extraordinary.

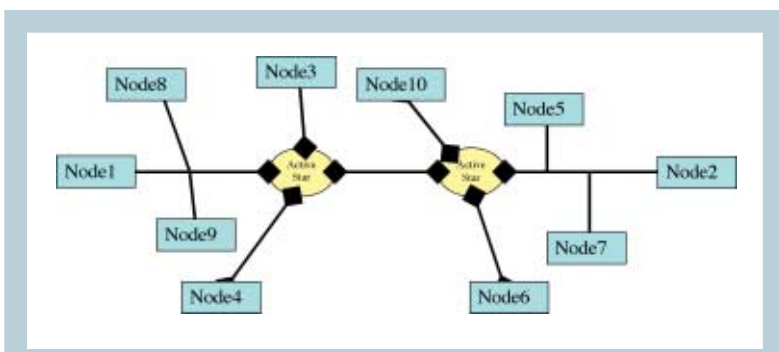
Robust communication by simulation of the network

As a useful approach to examine if the desired network allows a robust communication is the following way:

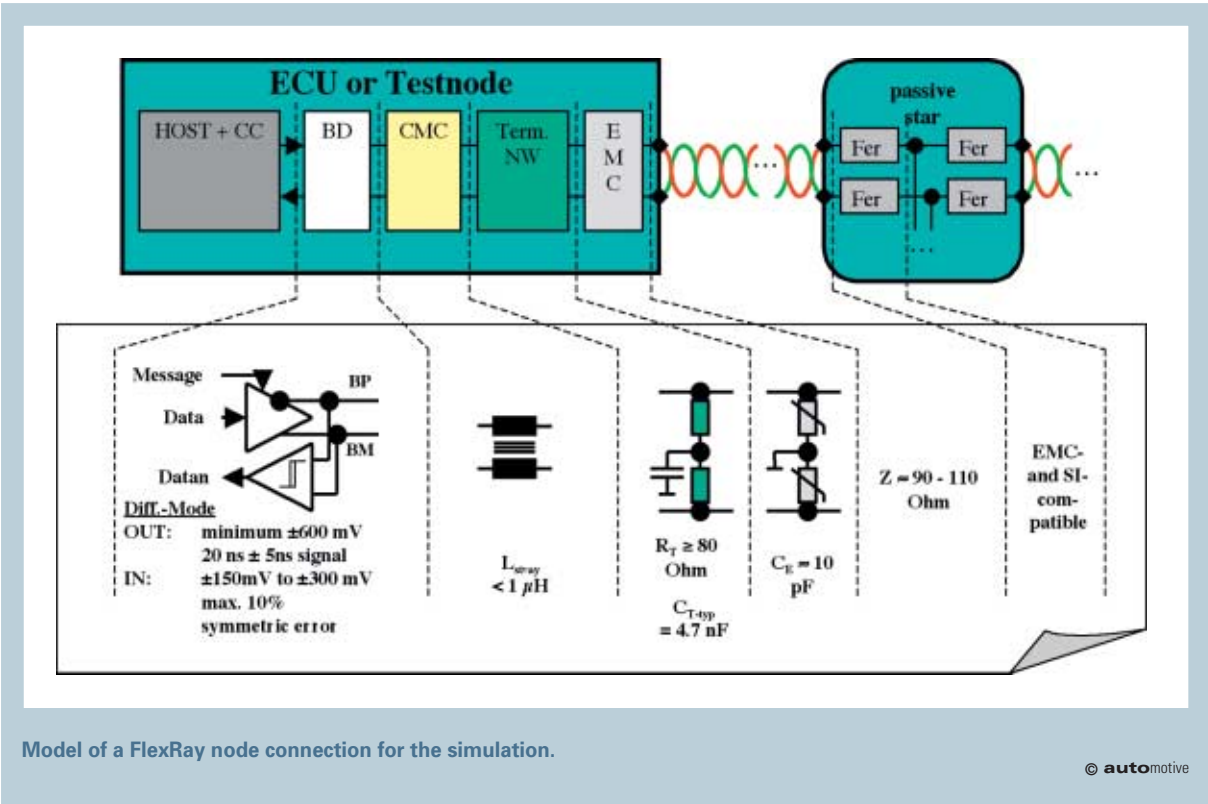
First the network with all its relevant parameters will be designed in a description language. Because of their very small influence some components are not considered.

The next step is the simulation of the network with the variation of the general set-up in a very broad range. The results may show the critical areas, which will then be examined in detail, if necessary.

If the described network will not fulfil the demands it could be optimized in the critical areas, which have been identified by the simulation. Then a new simulation run will be started and evaluated. This step will be continued as often as necessary until an acceptable solution is found.



Example of a FlexRay network topology which may be used in a car.



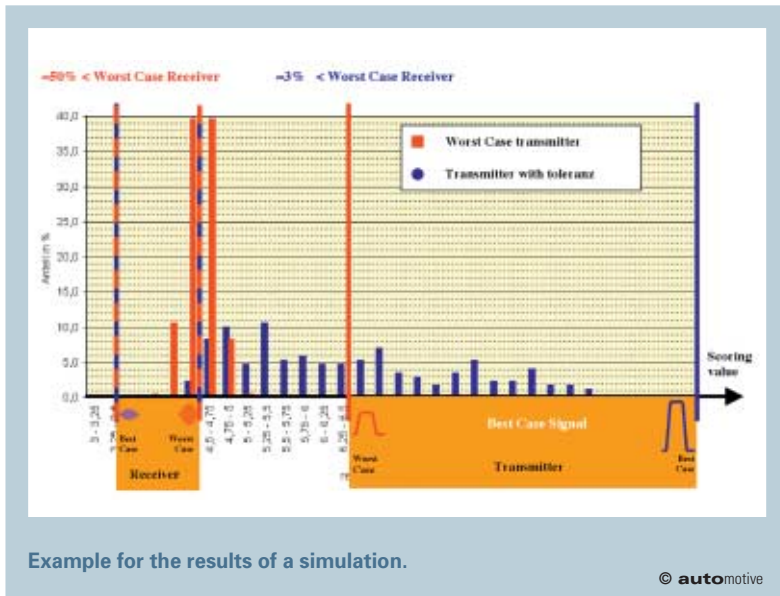
Model of a FlexRay node connection for the simulation.

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Integration and test of the network in the vehicle

After this verification the network can be used in the car. Because of the exactly known tolerances a reliable work of the communication in a broad range is guaranteed. Only the EMC examinations are left to be done now.

First simulations, which were executed this way have been performed successfully at TZM and show impressive the advantages of this method. The positive results have achieved, that TZM is improving this method to a powerful and fast accessible tool for everybody. This consists of two parts: first a powerful simulation program and second a flexible test system to verify the simulation values. This test system is build up at TZM at the moment. Detailed information about this theme is available at TZM.



Example for the results of a simulation.

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Because of the very detailed results of a simulation, a good solution normally will be found during a few runs. In the simulation are also created some striking parameters for the laboratory test, which allow easily a verification of the simulation.

Test of the investigated network parameters in the laboratory

The last step before the integration is the verification of the simulated topology within a laboratory assembly. With this way it is possible to see if the simulation model was correct and gives you the security that the network will work as planned.

Information about this theme is available at TZM.

Conclusion

Only the systematic, computer aided network design gives the possibility to control the great variety of parameters like in a FlexRay network within an acceptable time.

Also only this method gives the possibility for a sufficient worst-case examination to be prepared for unpleasant surprises in series production



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