

WAVE PROPAGATION MODELING FOR COMMUNICATION BETWEEN MOVING VEHICLES

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In recent years the road traffic density has been increasing drastically and it seems that this trend has not yet come to an end. The large number of vehicles on the streets leads to congestion and many accidents. A necessary step to solve the problem is to provide the driver with specific information, i.e. any driver will be able to get just the information he needs, depending on his individual driving route. This includes mobility-relevant information (e.g. online information about the actual traffic conditions on the whole route) as well as safety-relevant information (e.g. detailed information about the road and traffic conditions in the vicinity of the vehicle). Thereby, the primary goal is to improve the traffic flow, avoid accidents and shorten journey lengths. Beyond this, the increasing demand for mobile computing will have the future automobiles being equipped with high data rate access to the internet. Various multimedia applications, such as video on demand, games, email, etc. will be available. To provide automobiles with the large amount of information, inter-vehicle communications (IVC) will be a necessary tool.

It is expected that in the future all vehicles on a road are able to communicate with each other and to share data. As the number of participants in such a dynamic communication scenario is fluctuating rapidly, IVC will be organised in an ad-hoc network manner.

A detailed knowledge about the inter-vehicle transmission channel is necessary for the design and optimisation of IVC systems. Basis for these investigations are typical high resolution time series of impulse responses (IRs) of the physical radio channel between automobiles. A new IVC-channel model is therefore developed, which is able to provide realistic time series of IRs in a quasi-continuous manner. The model can be divided in three major parts consisting of a realistic model for the dynamic road traffic, a comprehensive approach to model the environment adjacent to the road, and an accurate model to calculate the multi-path wave propagation between the transmit and receive vehicle. As wave propagation model, a ray-optical approach is implemented. The resulting IRs incorporate the complete channel information and can be directly used for system simulations.

The three different parts of the model will be presented. Finally, comparisons with measurements of typical traffic environments at 5.2 GHz are presented showing a good agreement.

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