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Development of a MATLAB Toolbox for mobile radio channel simulators

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A profound knowledge of mobile radio channels is required for the development, evaluation, and also assessment at practical conditions of present and future mobile radio communication systems. The modelling, analysis, and simulation of mobile radio channels are important sub area since the initiation of mobile communications. In addition to that knowledge of channel behaviour in mobile radio communication is extensively recommended for the study of transmitter/receiver performances. Our intention in this research work is to develop various kinds of mobile fading channel simulators using MATLAB and embed them into MATLAB software as a toolbox.

Implemented channel simulators were combined into a user-friendly Matlab toolbox from which users can easily select well-known channel models to test and to study the performance of mobile communication systems. It gives better support for the new users to work on the developed channel simulators, run the test procedures as well as parameter computation.

The toolbox contains channel simulators for simulating non-stationary land mobile satellite channel, spatial shadowing processes, MIMO channels, multiple uncorrelated Rayleigh fading channels, mobile to mobile channel, frequency hopping channels etc. We developed set of test procedures, such as the autocorrelation function ACF, average duration of fades ADF, the probability density function PDF, and the level-crossing rate LCR [1, 2] etc., in order to test and to confirm the correctness of the implemented channel simulators. Proposed new algorithms to compute the model parameters of the channel simulators were also implemented in the toolbox to enable the parameterization of the channel simulators under specific propagation conditions. Finally, “how can a channel simulator be tested?” have been address in this work as research question. It was based on the comparison of simulation results with the measured model or the reference model under different scenarios. In addition to that selection of the simulation time duration, sampling rate and size of the samples were considered. Some of the simulation models were implemented based on specification of GSM system by CEPT-COST 207.

Keywords: Matlab toolbox, parameter computation methods, Mobile fading channel simulators, Performance tests, Deterministic channel modelling