Deterministic Propagation Modeling for the Realistic High-Speed Railway Environment

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Abstract:

In a realistic high-speed railway environment, the track, terrain, vegetation, cuttings, barriers, pylons, buildings, and crossing bridges are the main sources of reflection, diffraction, and scattering. Moreover, the radiation pattern and the polarization of the transmitting and receiving antennas considerably influence the propagation. This paper presents a deterministic modeling approach covering all the effects in a realistic highspeed railway environment for the first time. The antenna influence and the mechanisms of transmission, scattering, and reflection are evaluated by developing a 3D ray-optical tool. The diffraction loss is obtained by the multi-edge diffraction models using raster databases. This approach compensates the limitation of the existent empirical and stochastic models used for the high-speed railway, and promotes the deterministic modelling towards to the realistic environment. Therefore, it allows a detailed and realistic evaluation and verification of the train control communications systems.