Abstract

The work in this thesis is aimed at (i) physical understanding of wave propagation in urban environment and (ii) to develop an accurate and efficient deterministic propagation model for radio channel characterization of such environment. The first part of the work proposes a new reciprocal heuristic diffraction coefficient for lossy dielectric wedge which is applicable for arbitrary positions of transmitter and receiver in a complex urban environment. The prediction obtained using proposed coefficient is compared with those obtained using accurate rigorous Maliuzhinets'solution and available measurement. Further, the measurements of the electric field in the vicinity of edge of the building are carried out and the measurement results, thus obtained, are compared with predictions using proposed coefficient.

Second part of this thesis proposes a novel three-dimensional dyadic diffraction coefficient to deal with field that may be obliquely incident and polarized in any direction relative to the edge. The proposed dyadic coefficient shows significant improvement when compared with published measurement results. Further, three dimensional rooftop scenario is investigated and measurement of the electric field in the vicinity of the building is carried out. The measurement result, thus obtained, is compared with predictions using proposed dyadic coefficient.

Third part of this thesis proposes a fast two-dimensional ray tracing algorithm for characterization of radio channel environment. With the proposed ray-tracing algorithm, considerable computation reduction can be achieved without compromising on prediction accuracy. The proposed algorithm is tested by some numerical examples that shows its efficiency and efficacy.

The last part of the thesis proposes an accurate deterministic model along with Uniform Theory of Diffraction (UTD) computed external diffraction and transmission model to predict path loss in the shadow of a building. The prediction, thus obtained, is compared with available measurement for a single building case. Further, the model is applied to urban scenario of Bern city and path loss prediction, thus obtained, is compared with available measurement.

Keywords: Uniform theory of diffraction (UTD), deterministic propagation channel modeling, dielectric wedge, ray tracing, radio wave propagation, multiple diffraction, slope diffraction, transmission model, microcellular scenario, path loss.