Statistical Model of the Influence of Body Dynamics on the Radiation Pattern of Wearable Antennas in Off-Body Radio Channels

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Abstract:

The goal of this paper is to address a statistical approach for modelling body dynamics on the radio link performance in Body Area Networks, particularly in off-body radio channels. A dynamic model was developed based on Motion Capture data, describing a realistic human body movement. Antennas were located in 4~typical positions (i.e., Head, Chest, Arm and Leg), for which statistics of main radiation direction (i.e., average and standard deviation of elevation and azimuth angles) were calculated for 2~dynamic scenarios, i.e., Walk and Run. Based on the r otation of antenna, the statistics of radiation pattern of a wearable patch antenna operating at 2.45~GHz were calculated.
The standard deviation of the change in the main radiation direction is the highest for the Arm location, reaching 19° and 36° for the Run scenario, for elevation and azimuth angles, respectively. Except the scenarios for which standard deviation is below 4°, the distribution of the change in the main radiation direction, fit successful to a Kumaraswamy distribution (using $\mathbf{\chi^2_{95\%}}$ test). For all antenna positions and the Walk scenario, the standard deviation is less than 4°.