Multisatellite channel model for LEO constellations without measurements

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Extended Abstract

Low-Earth-Orbit (LEO) satellite constellations are foreseen to represent a key enabling technology for future 6G communication systems, which aim at achieving the integration between Terrestial and Non-Terrestrial Networks. However, to provide continuous coverage, several LEO satellites need to be contemporarily in sight of a ground user. It becomes then important to develop multisatellite channel models for LEO satellites, which can take into account the correlation of the different channels, especially in urban environment. Among the previous works, limited to 2 satellites, [1] relies on a Markov-chain model, whose transition matrix is the Kronecker product of the single-satellite transition matrices. Instead, [2] proposes a quasi-Markov channel model, whose parameters are derived based on specific measurements. In this work, we propose a quasi-Markov channel model, similar to [2], which is parametric with respect to the correlation, assumed known, between any two pairs of satellites. We start from the single-satellite model in [3], which is a semi-Markov model with only two states, good (G) and bad (B). The evolution of the channel conditions corresponds to an alternate sequence of states G and B. The duration of each state occurrence is a lognormal random variable, independent of the others. Within a given state occurrence, the channel coefficients obey a Loo distribution with parameters that are also random. If m is the number of satellites, our proposed model has 2^m states, corresponding to the G-B state of each of them. We consider the duration of the individual states for each satellite as correlated lognormal random variables. Also, the model may encompass correlation also at the level of channel coefficients. The main feature of our model is that it is consistent with the single-satellite model, in the sense that, marginalized with respect to a given satellite, the distribution of the G-B states is the same as the single-satellite model from [3] for that satellite. Another consequence is that, unlike [2], our model does not need any field measurement, given that the correlation is known. Our model can be an easy and effective way to perform simulations on multisatellite communication systems.

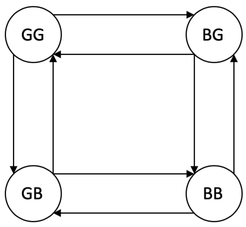

Figure 1. Semi-Markov model for 2 satellites

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