

Mitigation of Interference in Satellite Communications Systems via a Cross-Layer Coding Technique

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Abstract : An important problem in satellite communication systems which operate in the Ka and EHF frequency bands consists of the overall degradation in link performance of mobile terminals due to various types of degradations in the link/channel, such as fading, blockage of the link to the satellite (especially in urban environments), intentional as well as other types of interference, etc. In this paper, we focus primarily on the interference problem, and we develop a very efficient and cost-effective solution based on the use of fountain codes. We first introduce a satellite communications (SATCOM) terminal uplink interference channel model that is classically used against communication systems that use spread-spectrum waveforms. We then consider the use of fountain codes, with focus on Raptor codes, as our main mitigation technique to combat the degradation in link/receiver performance due to the interference signal. The performance of the receiver is obtained in terms of average probability of bit and message error rate as a function of bit energy-to-noise density ratio, E_b/N_0 , and other parameters of interest, via a combination of analysis and computer simulations, and we show that the use of fountain codes is extremely effective in overcoming the effects of intentional interference on the performance of the receiver and associated communication links. We then show this technique can be extended to mitigate other types of SATCOM channel degradations, such as those caused by channel fading, shadowing, and hard-blockage of the uplink signal.

Keywords : SATCOM, interference mitigation, fountain codes, turbo codes, cross-layer

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