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On the Secrecy Performance of NOMA-Based Integrated Satellite Multiple-Terrestrial Relay Networks With Hardware Impairments

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2019 IEEE 19th International Conference on Communication Technology (ICCT)
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- II. System Model and Problem Formulation
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Integrated satellite terrestrial networks and non-orthogonal multiple access (NOMA) have been confirmed to be promising and effective approaches to achieve substantial performance gains for future wireless paradigms. This paper studies the effect of hardware impairments (HIs) on the secrecy performance of NOMA-based integrated satellite multiple-terrestrial relay networks (ISMTRNs). Particularly, we consider two important wiretapping cases: Case I, colluding case: all eavesdroppers cooperatively overhear the information; and Case II, non-colluding case: one eavesdropper with the best wiretapping quality is chosen to overhear the main channel information. Specially, the closed-form expressions for the secrecy outage probability (SOP) of the considered NOMA-based ISMTRNs in the presence of the above two eavesdropping cases and partial relay selection scheme are obtained. To obtain further insights in high signal-to-noise ratios (SNRs) regime, the asymptotic analysis of SOP with two considered cases are also derived, which give efficient means to evaluate the benefit of NOMA scheme and the impacts of HIs on the SOP. Moreover, we obtain Monte Carlo (MC) simulations for the secrecy energy efficiency (SEE).

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Contents

I. Introduction

The integration of satellite communication (SatCom) networks with the

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terrestrial mobile networks is one of the key element for the sixth-generation (6 G) and next generation networks due to enhanced capability and widely covered area [1], [2]. SatCom has been utilized in many fields, such as rescue, broadcasting and broadband because it can bring the high reliability, reduce the latency, enlarge the coverage area and give low-cost and energy-efficient methods [3]. However, the coverage region may be reduced by the obstacles and shadowing between the terrestrial users and satellite, which results in the unavailability of the line-of-sight (LOS) links [4]. On this condition, the terrestrial relay is utilized to solve this shortage [5], which leads to the framework of the integrated satellite-terrestrial relay networks (ISTRNs). The main idea of ISTRNs is to utilize terrestrial relays to forward the signal of the satellite, which is becoming a promising architecture for the SatCom, especially for the fixed satellite service and mobile satellite service, which has been used in the real systems such as SiriusXM [6]. In fact, ISTRN has been incorporated in Digital Video Broadcasting (DVB) system which provides Satellite services to Handheld devices (SH), leading to the standard known as DVB-SH [7], ISTRN has been concluded in "Space-Ground Integrated Information Network Engineering" of China [8].

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