LIS

Laboratoire d'ingé
des systèmes de Vers

SEMINAR OF DR WAFAA MOHAMMED RIDHA SHAKIR

Dr Wafaa Mohammed Ridha Shakir, assistant professor in the Department of Computer Systems at Al-Furat Al-Awsat Technical University (Iraq) will present her works about "Secrecy and Reliability Performance Evaluation of Hybrid Free Space Optical/Millimeter-Wave Systems over Unified Channels for 5G Cellular Networks". The seminar will be in Casimir room in LISV at 10 am the 25 may 2022 (and a zoom link will be send if you cannot attend in LISV).

1.0 Context

The increasing requirement for extremely high data rates in the next generation mobile systems (5G and beyond) require backhaul links with far higher capacity and reliability than previous systems. The conventional radio frequency (RF) backhaul can be potentially limited by latency problems due to the low capacity but is advantageous of being insensitive to weather effects. The broadcasting nature of radio wave propagation also makes RF communication vulnerable to eavesdropping attacks. Free space optical

(FSO) communication, on the other hand, provides high-rate and low-latency transmission while being very vulnerable to atmospheric conditions and adverse weather impacts. a hybrid setup of FSO and RF communication systems have been developed as a more reliable candidate solution for backhaul networks as an integral part of 5G systems and in a variety of other applications. There are two types of hybrid FSO/RF setup configurations: parallel FSO/RF and cascaded or mixed FSO–RF systems, in which the FSO link is just one part of the cascaded FSO–RF dual-hop relay system.

2.0 Goals and expected contributions

The secrecy performance of the hybrid FSO/RF systems is still, an open topic since there are relatively few studies that have conducted an overall investigation of such systems' secrecy performance. To our knowledge, no comprehensive examination of the hybrid FSO/RF system's overall security performance has been conducted. Along with conducting physical layer security (PLS) study of hybrid FSO/RF system configurations, this research will evaluate the configuration's secrecy performance under the impacts of eavesdropping on both links. Additionally, because wireless channels fluctuate often over time, employing an F-distribution fading channel model for RF links provides a more realistic study of hybrid FSO/RF systems. On the other hand, the F-distribution turbulence model of the considered system's FSO links may also produce comprehensible results in the presence of severe atmospheric turbulence and pointing error impairments. We will demonstrate a secure scenario hybrid FSO/RF over unified F-distribution turbulence fading channel considering these advantages.

3.0 Methodology

(1). Despite the great potential of hybrid FSO/RF systems, including their two types, i.e., parallel FSO/RF and cascaded FSO/RF networks, as strong candidates for the backhaul network of future networks and a variety of other applications, the physical layer security performance of hybrid radio/optical systems has not been fully analyzed in the open literature using a unified channel model for both links. Thus, we will study and analyze the secrecy performance of such setups in this research. We propose the F -distribution turbulence fading to characterize both radio and optical links contrary to previous PLS works on such systems, where the FSO and RF links were modeled with different turbulence and fading distributions. The proposed unification of the channel models will facilitate tracking the security performance of these systems under the influence of various system and channel characteristics.

(2). To make the analysis more practical, the major impairments or characteristics of the

FSO and RF links will be considered (e.g., power amplifier (PA) inefficiency, multipath fading, shadowing effects for the RF link, and atmospheric turbulence, misalignment, pointing errors, detection types, and weather conditions for the FSO link), in contrast to previous works in this field, which have considered only a few or some impairments.

(3). We will derive the exact analytical expressions for the secrecy outage probability (SOP), probability of strictly positive secrecy capacity (SPSC), and the average secrecy capacity (ASC), secrecy rate (SR), in contrast to previous works, which computed only a subset of these secrecy metrics.

(4). The asymptotic secrecy analysis for the SOP, SPSC, and ASC metrics will be performed, and the related diversity orders under various situations will be produced, revealing some helpful insights into the PLS performance of the two-hybrid system configurations under investigation.

(5). Following that, we will develop, construct, and present a novel mathematical tool that properly assesses PLS performance measures using the realistic system and channel characteristics as input. The computational tool will evaluate the secrecy performance of the system using the obtained expressions for the SOP, SPSC, ASC, and SR. The entire program will be designed with a simple Graphical User Interface (GUI).