# Secure UAV Communications with Non-Orthogonal Multiple Access

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## Abstract

With the development of 5G in wireless networks, Unmanned Aerial Vehicles (UAVs) has been emerged as a potential component for supporting broadcast and increasing transmission rate. UAV possesses many advantages in comparison with conventional terrestrial infrastructure. Non-orthogonal Multiple Access (NOMA) has been investigated in recent years. In an UAV-aid communication system, physical layer security is focused due to its significant effect on system performance. In this brief, we discuss a solution to secure UAV Communications communication adopting NOMA transmission.

## 1. Introduction

UAV has been proved to have extensive usage in many fields. Currently, in demand of seamless and massive connection, UAVs is one of the key technologies. NOMA is a concept that was proposed to support more connections than the orthogonal resources. There are 2 dominant NOMA schemes: *power-domain* and *code-domain*. Along with UAV, NOMA is an innovative concept for supporting massive connections in 5G wireless network. In a UAV-aid communication system, UAV usually have a line-of-sight (LoS) channels to communicate with ground user. Such communication links are subjected to eavesdropper on the ground. In this scope we discuss solutions to secure UAV communication using power-domain NOMA scheme.

## 2. System model and proposed approach

As in Fig. 1 we consider a wireless network setting, where an UAV is deployed as the flying base station (FBS) to serve multiple ground users (GUs), while a passive eavesdropper (EV) tries to intercept the communication between UAV and GUs. Each GUs and EV are equipped with single-antenna. We assume that the communication links between UAV and GUs are dominated by the LoS, and GUs

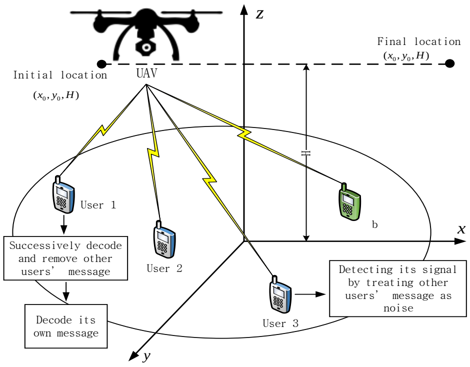


Fig. 1. Typical NOMA-based UAV-aid communications.

side can compensate the Doppler shift created by UAV's mobility. Also, power-domain NOMA is adopted. At the receiver side, the successive interference cancellation techniques can be used to decode received signals based on the differences in signal strength among the signals of interest. There are 2 major challenges:

- Secrecy rate can be limited if the distance between FBS and GUs is fixed and significantly larger than between FBS and EV.
- The channel state information of passive EV is usually required at GUs for effectively power control.

Therefore, physical layer security is applied as well as the optimization of UAV trajectory and transmit power is considered over a given time period. Since the formulated problem is non-convex and NP-hard in general, it is difficult to be solved optimally. We proposed an algorithm that is based on block coordinate descent and successive convex approximation methods.

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