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Integrating Drones into 5G and Beyond: How to Effectively Control Air-to-Ground Interference?

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Date and Time: Friday, 27 September 2019, 4:30pm – 5:30pm
Venue: Room **CD634**, Hong Kong Polytechnic University
Reception starts at 4:15pm
(Language: **English**)

Abstract

Recently, unmanned aerial vehicles (UAVs) or drones have found a wide range of applications in package delivery, video surveillance, and many others, thanks to their flexible deployment and high mobility. Integrating UAVs into the cellular network as new aerial users is a promising solution to meet their ever-increasing communication demands. Due to the high UAV altitude, the channels between UAVs and the ground base stations (GBSs) are dominated by the strong line-of-sight (LoS) links, which brings both opportunities and challenges. On one hand, a UAV can communicate with a large number of GBSs at the same time, leading to a higher macro-diversity gain as compared to terrestrial users. However, on the other hand, severe interference may be generated to/from the GBSs in the uplink/downlink, which renders the interference management with coexisting terrestrial and aerial users a more challenging problem to solve.

In this talk, we consider the uplink communications from one multi-antenna UAV to multiple GBSs (e.g., the UAV sends back its video to GBSs for surveillance). To leverage the macro-diversity gain, we adopt the multi-beam transmission strategy where the UAV sends multiple beams to the GBSs. Furthermore, to protect the ground communications, we propose two novel interference cancellation based strategies for interference control, namely cooperative interference cancellation and local interference cancellation. In the former scheme, the GBSs that can decode the UAV messages forward these messages to other GBSs via the backhaul links for interference cancellation, while in the latter scheme, each GBS utilizes the non-orthogonal multiple access (NOMA) technique to first decode the UAV messages and then cancel them before decoding the ground users' messages. The achievable degrees-of-freedom (DoF) for UAV rate maximization is characterized for both strategies. We conclude this talk by introducing some interesting future work directions for the cellular-enabled UAV communications.

About the Speaker

Dr. Liang Liu received the B.Eng. degree from the Tianjin University in 2010, and the Ph.D. degree from the National University of Singapore in 2014. He is currently an Assistant Professor in the Department of Electronic and Information Engineering at the Hong Kong Polytechnic University. Before that, he was a Research Fellow in the Department of Electrical and Computer Engineering at National University of Singapore from 2017 to 2018, and a Postdoctoral Fellow in the Department of Electrical and Computer Engineering at University of Toronto from 2015 to 2017. His research interests include the next generation cellular technologies and machine-type communications for Internet of Things. Dr. Liang Liu is the recipient of the IEEE Signal Processing Society Young Author Best Paper Award, 2017, and the best student paper award for International Conference on Wireless Communications and Signal Processing (WCSP), 2011. He is recognized by Clarivate Analytics as a Highly Cited Researcher 2018.

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