Adaptive Millimeter-Wave Channel Estimation and Tracking

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***Abstract*— Computationally efficient channel estimation is critical to optimize the capacity of millimeter-wave communication network. For this, compressed-sensing has been recommended to estimate a few dominant channel parameters. However, it is challenging to extend compressed-sensing solutions to a continuous channel tracking due to the number of required measurements. In this paper, we propose efficient adaptive channel estimation and tracking for millimeter-wave communication with minimum communication overhead. We recommend characterizing the instantaneous rate of change of the millimeter-wave channel as a gradient of spectral overlap between channels. The significant channel variations are then detected locally by applying convergence in mean square sense to the resultant time sequence. If the channel experiences significant variation, then the multipath components are estimated directly using compressed-sensing. Otherwise, the channel parameters are updated using the channel tracking model. For this purpose, we introduce an efficient channel tracking model based on small-angle assumption. The proposed channel tracking method employs an autoregressive process to update the angle of departure and angle of arrival. We present numerical results to evaluate the proposed adaptive channel estimation and tracking method.**

***Keyword*—Millimeter-wave massive MIMO, channel tracking, channel estimation, channel variation rate, convergence in mean square**

Mohammadreza Robaei was born in 1983 in Tabriz, East Azerbaijan, Iran. He received B.Sc. in electrical and Electronics from Tabriz Azad University, Iran, in 2006, and M.Sc. in Electrical Engineering from Middle East Technical University, Ankara, Turkey, in 2015. He received M.Sc. in Information Systems and Technology from the University of Michigan, Dearborn, US, in 2017. In 2018, he joined the Ph.D. program at the University of North Texas, Denton, TX, where he is currently working on millimeter-wave communication signal processing.
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Robert Akl received his B.S. in Computer Science and B.S. in Electrical Engineering in 1994, his M.S. in Electrical Engineering in 1996, and his D.Sc. in Electrical Engineering in 2000, all from Washington University in Saint Louis. He is currently a Tenured Associate Professor at the University of North Texas and a Senior Member of IEEE. He has designed, implemented, and optimized both hardware and software aspects of several wireless communication systems for cellular, Wi-Fi, and sensor networks.

Dr. Akl has broad expertise in wireless communication, Bluetooth, Cellular, Wi-Fi, VoIP, telephony, computer architecture, and computer networks. He has been awarded many research grants by leading companies in the industry and the National Science Foundation. He has developed and taught over 100 courses in his field. Dr. Akl has received several awards and commendation for his work, including the 2008 IEEE Professionalism Award and was the winner of the 2010 Tech Titan of the Future Award.

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