

In-band Full-Duplex Radios for Military Communications

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Within a MATINE research project, we have recently begun to study whether and how the progressive simultaneous transmit and receive (STAR) capability of modern in-band full-duplex (IBFD) radio transceivers [1, 2] could be advantageous in military applications as well [3]. Whereas IBFD operation facilitates up to doubled spectral efficiency by frequency reuse in civilian/commercial applications, the STAR capability could revolutionize military systems by merging tactical communications and electronic warfare.

THE RECENT ADVANCES IN NON-MILITARY SYSTEMS

After few early sporadic publications by visionaries, academic research on IBFD communications started on full blast in the end of the last decade concurrently (but presumably independently) in various institutes around the globe. Almost all the subsequent scientific advances have focused exclusively on non-military, i.e., commercial or civilian, communications at cellular mobile radio bands. The first challenging technical problem has been to cancel the self-interference (SI) due to STAR operation and so demonstrate that it is feasible to implement IBFD transceivers to begin with. Thereafter, the recent research has generated thorough understanding on the prospects and challenges of IBFD radios in non-military applications for improving spectral efficiency. Currently, the basic scientific work is already giving way for R&D projects in the telecommunications industry such that the first commercial products are just around the corner. [1, 2]

THE FUTURE ADVANCES IN MILITARY SYSTEMS

Military radio channels are scarce and congested, whereupon the defense industry shares the telecommunications industry's motivation to improve spectral efficiency by using IBFD transceivers. In addition, we work on two open research directions related to this potentially disruptive technology in military systems:

- 1) Apart from requiring both extreme sensitivity for desired signals and extreme robustness against hostile signals, many military radios would actually operate at HF or VHF bands whereas academic prototypes have demonstrated the feasibility of SI cancellation at upper UHF bands only. Thus, it is still unknown whether and how the STAR capability can be implemented for military systems.
- 2) We envision that armed forces could gain a major technical advantage from radio transceivers that conduct electronic warfare, e.g., signals intelligence or jamming, simultaneously when they are receiving or transmitting other signals, e.g., tactical communications, at the same band [3]. Thus, our project characterizes all and the best uses for the STAR capability at cyber-electromagnetic battles.

Resolving the above points may induce a paradigm shift in tactical communications and electronic warfare.

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