COMPILED AND EDITED BY THE **CONNECT TEAM** BASED ON INPUT FROM THE FEATURED **RESEARCHERS**

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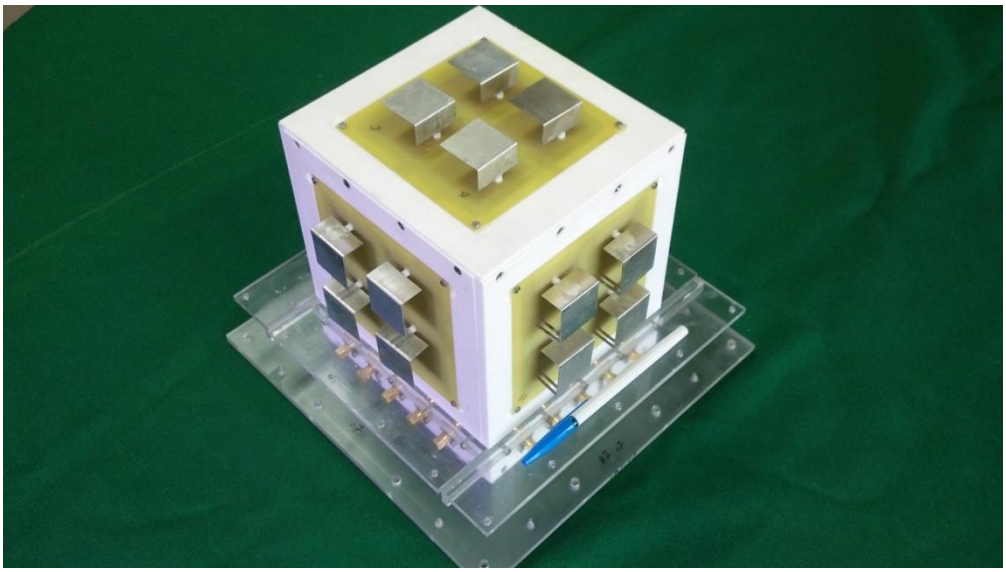
Research in large-scale mimo systems

Multi-antenna wireless communication has become immensely popular because of its unique advantage of achieving increased data rate (without increasing bandwidth) and link reliability. Large-scale multiple-input multiple-output (MIMO) systems with `tens to hundreds of antennas are being considered for 5G wireless standards. Chockalingam and Sundar Rajan's labs have made pioneering contributions in the area of large-scale MIMO systems (now popularly called *Massive MIMO systems*). They have developed near-optimal low-complexity receiver algorithms that broke the optimum receiver complexity barrier encountered in large dimensions. These algorithms are rooted in artificial intelligence and machine learning; algorithms based on local search and meta heuristics (tabu search, for

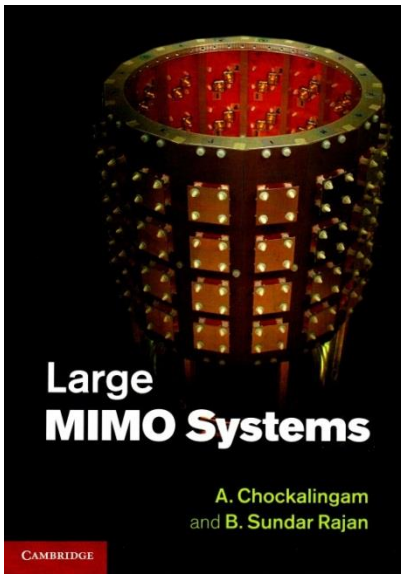
example), belief propagation/message passing and Monte Carlo sampling methods. Ingenious ideas in these proposed algorithms with carefully balanced performance and complexity were instrumental in the success of these algorithms for signal detection in large-scale MIMO systems. This collaborative research by these two electronics communication engineers resulted in the early development of the field of large-scale MIMO systems. They also have several US patents granted in this area.

More recently, recognizing the value and importance of translating their research output into practice, Chockalingam and Sundar Rajan, jointly with DRDO and partners from industry, have developed a large-scale MIMO system that uses 16 transmit antennas and 20 receive antennas in the 2.5 GHz band. The basic design and implementation approach for this system are based on their patents on large-scale MIMO.

Chockalingan and Sundar Rajan have also authored a book titled *Large MIMO Systems*, published by Cambridge University Press in 2014. It is the first book to take an in-depth look into large MIMO systems with tens to hundreds of antennas. A Chinese edition of this book is being planned by the publisher.



A 20-Antenna MIMO Cube (Courtesy: Chockalingam and Sundar Rajan)



Book on the subject (Courtesy: Chockalingam and Sundar Rajan)