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Source Separation and Equalization for Interference-Limited Communications

MITRE is developing receiver technologies that can jointly separate, equalize, and decode arbitrary wideband signals within an asynchronous, multi-antenna, multiple-access channel. The receiver must separate common format signals for wireless network optimization and different format signals for eavesdropping applications. The target system will recover bit streams for all acquired signals of any type in the particular catalog.

The receiver must employ multiple antennas and use advanced signal processing methods referred to as source separation. The multiple transmit platforms transmitting in the same time-frequency slot create a multiple access channel at the receiver. There must be as many antenna elements as arriving signals to perfectly recover all the streams.

The joint separation, equalization, symbol synchronization, and channel estimation all fit within a similar MIMO context to the Spatial Multiplexing (SM) Multiple Input Multiple Output (MIMO) architecture currently being developed. Fortunately, these joint estimation objectives can be accomplished using frequency domain multichannel equalization techniques coupled with the appropriate use of training data at the beginning of each packet.

Applications

In addition to optimizing wireless network performance and developing optimal detection systems, a source separation receiver can be very useful for Anti-Jamming (AJ), Low Probability of Intercept/Low Probability of Detection (LPI/LPD) communications, and spectral reuse for existing military radios. The battlefield requirement for reliable communications that are robust in the presence of jamming and that maximize the use of limited spectrum resources will always be present.

Benefits

Our nation's security depends heavily on reliable communications and communications-related detection systems. A solution for the interference-limited radio channel will enable our military radio communications and detection systems to operate with maximum reliability and efficiency.

Additional Information

Comar, B. B., L. Mili, R. M. Taylor, Jr., and A. Zaghoul, 2006, "A Novel Synchronization, Channel Estimation, and Frequency Domain Multichannel Equalization Technique for Single-Carrier MIMO Systems," IEEE International Conference on Computer and Communication Engineering.