Mathematical Tools for Processing Broadband Multi-Sensor Signals

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In this keynote I will motivate the development of tools for broadband sensor array problems that directly extend wellestablished narrowband approaches. For narrowband problems, formulations via the covariance matrix derived from the sensor data lead to optimal solutions in various senses based on factorisations such as the eigenvalues decomposition (EVD) of this covariance matrix. Such factorisations are well-supported by linear algebra. For broadband problems, a space-time covariance matrix, which explicitly depends on a lag term, or when z-transformed, on the complex variable z. Factorisations equivalent to the EVD now must diagonalise this matrix for every lag value, or every value of z. I will report on the existence of such decompositions, algorithmic solutions, and demonstrate the resulting narrowband extension by exemplarily designing a broadband beamformer.