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Mapping the Interactions between Shocks and Mixing Layers in a 3-Stream Supersonic Jet[1] JACQUES LEWALLE, Syracuse University, CHRISTOPHER RUSCHER, Spectral Energies LLC, PINQING KAN, ANDREW TENNEY, Syracuse University, SIVARAM GOGINENI, Spectral Energies LLC, BARRY KIEL, Air Force Research Laboratory — Pressure is obtained from an LES calculation of the supersonic jet ($Ma_1 = 1.6$) issuing from a rectangular nozzle in a low-subsonic co-flow; a tertiary flow, also rectangular with $Ma_3 = 1$ insulates the primary jet from an aft-deck plate. The developing jet exhibits complex three-dimensional interactions between oblique shocks, multiple mixing layers and corner vortices, which collectively act as a skeleton for the flow. Our study is based on several plane sections through the pressure field, with short signals (0.1 s duration at 80 kHz sampling rate). Using wavelet-based band-pass filtering and cross-correlations, we map the directions of propagation of information among the various "bones" in the skeleton. In particular, we identify upstream propagation in some frequency bands, 3-dimensional interactions between the various shear layers, and several key bones from which the pressure signals, when taken as reference, provide dramatic phase-locking for parts of the skeleton.

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