

**Adaptive Suppression of Wigner Interference-Terms Using Shift-Invariant Wavelet
Packet Decompositions**

Israel Cohen, Shalom Raz and David Malah

**Department of Electrical Engineering
Technion - Israel Institute of Technology
Haifa 32000, Israel**

Abstract

The Wigner distribution (WD) possesses a number of desirable mathematical properties relevant to time-frequency analysis. However, the presence of interference terms renders the WD of multicomponent signals extremely difficult to interpret. In this work, we propose adaptive suppression of interference terms using the *Shift-Invariant Wavelet Packet Decomposition*. A prescribed signal is expanded on its best basis and transformed into the Wigner domain. Subsequently, the interference terms are eliminated by adaptively thresholding the cross WD of interactive basis functions, according to their amplitudes and distance in an idealized time-frequency plane. We define a distance measure that weighs the Euclidean distance with the local distribution of the signal. The amplitude and distance thresholds control the cross-term interference, the useful properties of the distribution, and the computational complexity. The properties of the resultant *modified Wigner distribution* (MWD) are investigated, and its surpassing performance, in eliminating interference terms while still retaining high energy resolution, is compared with that of other existing approaches. It is shown that the proposed MWD is directly applicable to resolving multicomponent signals. Each component is determined as a partial sum of basis-functions over a certain equivalence class in the time-frequency plane.