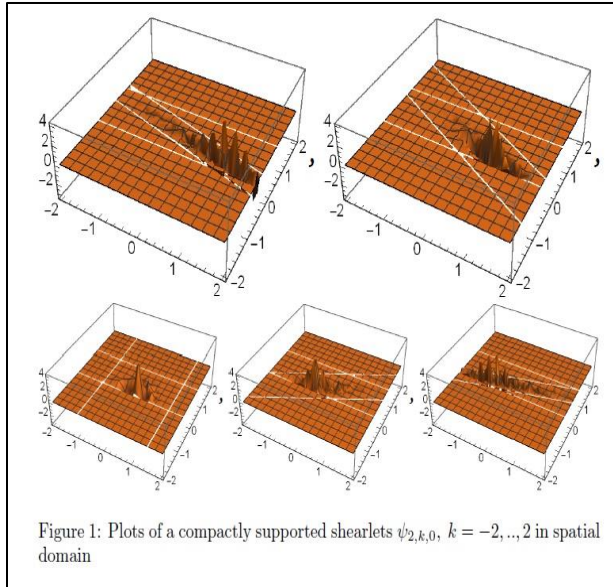


Compactly Supported Shearlets for the Sparse Representation of Singular Integral Operators

Many mathematical models, namely, e.g., elasticity, flow simulation, potential theory can be formulated through an operator equation with integral operator (IO)/ boundary integral operator (BIO), and most of the IO is singular in nature. Traditional methods of time-frequency analysis such as wavelets and Gabor frames have proven very efficient for the sparse representation of singular integral operator (SIO) but cannot handle singularities of functions/signals along a curve (anisotropic singularity). Shearlets, a multivariate



extension of the wavelet framework help to control the directional selectivity in a very efficient manner. We derive the sparse representation of SIO by using compactly supported shearlets. Also, a class of algorithm is introduced for the rapid numerical application of a class of SIO, e.g., we derive the quadrature rule for the integral involving product of integrable functions and compactly supported shearlets. Numerical experiments are given, which indicates that many previously intractable problems become manageable with the developed techniques.

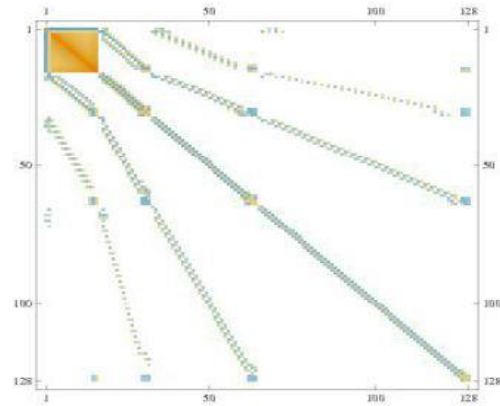
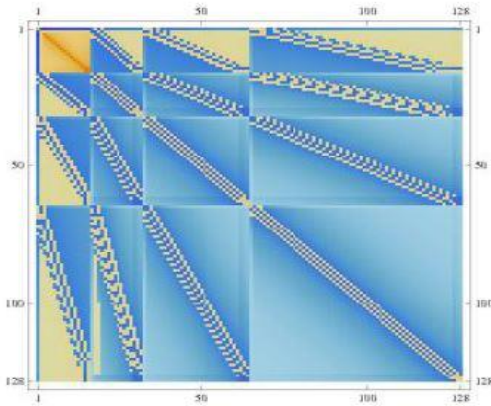


Fig. 2. Plot of matrix representation of singular integral operator after zero threshold in compactly supported shearlet basis **Fig. 3.** Plot of matrix representation of singular integral operator after threshold 10^{-3} in compactly supported shearlet basis