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*Directional Complex Tight Framelets with Applications to Image Processing*

Wavelet frames (i.e., framelets) with directionality are of great interest in both theory and application for high dimensional datasets and inverse problems. In this talk we first completely characterize tight framelets. Then we shall introduce a family of directional tensor product complex tight framelets (TPCTFs). The TPCTFs have all the desired properties of both classical wavelets and the discrete cosine transform. The tensor product structure of TPCTFs also means simple computationally fast algorithms for high dimensional problems. For several inverse problems in image processing such as image/video denoising and inpainting, we shall show that TPCTFs have impressive performance over many other known transform-based methods such as curvelets, shearlets, dual tree complex wavelet transform, and undecimated wavelet transform. Moreover, such TPCTFs can be made spatially compactly supported and can be employed in many other applications. This talk is based on several joint papers with Q. Mo, Z. Zhao, and X. Zhuang.