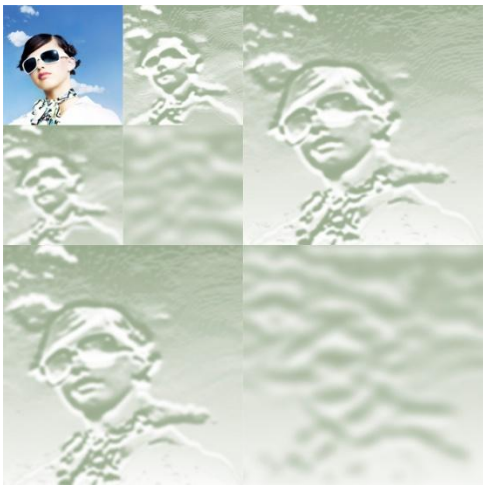
Wavelet analysis and its applications



Associated People:
Bin Han (University of Alberta)
Rong-Qing Jia (University of Alberta)

Associated Sites:
PIMS University of Alberta

University of Alberta mathematician Rong-Qing Jia and his research group have made remarkable progresses on applications of approximation theory and wavelet analysis to computational mathematics. By constructing wavelet bases for numerical solutions of biharmonic equations, R. Q. Jia and W. Zhao have shown that the numerical performance of their computational scheme is much better than any other known methods. R. Q. Jia and his students introduced the fastest algorithm so far for image denoising based on difference schemes. Their algorithms have been successfully applied to image processing by several research groups. Due to its ability to extract the multiscale structure in the data, wavelet transform has been proved to be a very successful tool widely used in many applications such as image compression, signal denoising and sampling, and computer graphics. To efficiently capture edge information in high-dimensional data, it is of fundamental importance to have directional systems to remedy the shortcoming of tensor product wavelets. University of Alberta mathematician Bin Han has successfully built high-dimensional directional framelets which not only inherit the usual advantages of wavelets such as multiscale representation and fast algorithm but also has the ability to capture directionality for dimensional data. Bin Han and his students are currently working on the applications of such directional framelets in image processing.

References:

- Bin Han, Nonhomogeneous wavelet systems in high dimensions, *Applied and Computational Harmonic Analysis*, **32** (2012), 169-196.

- Rong-Qing Jia and Wei Zhao, Riesz Bases of Wavelets and Applications to Numerical Solutions of Elliptic Equations, *Mathematics of Computation*, **80** (2011), 1525-1556.

- Rong-Qing Jia, Hanqing Zhao, and Wei Zhao, Relaxation Methods for Image Denoising Based on Difference Schemes, *Multiscale Modeling and Simulation*, **9** (2011), 355-372.