998-94-27 **Michael B Wakin*** (wakin@rice.edu), ECE Dept - MS 366, 6100 Main St., Houston, TX 77005, **Justin K Romberg** (jrom@rice.edu), ECE Dept. - MS 366, 6100 Main St., Houston, TX 77005, **Hyeokho Choi** (choi@rice.edu), ECE Dept - MS 380, 6100 Main St., Houston, TX 77005, and **Richard G Baraniuk** (richb@rice.edu), ECE Dept - MS 380, 6100 Main St., Houston, TX 77005. *Wavelet-domain Approximation and Compression of Piecewise Smooth Images.*

The multiscale wavelet representation suggests a simple zerotree modeling framework that is prevalent among general-purpose image coders. Results from the field of Nonlinear Approximation show that for smooth images, such quadtree-structured approximations are optimal; these results can be extended to asymptotic rate-distortion (R-D) bounds for simple, prototype image coders. Unfortunately, wavelets have significant shortcomings in their treatment of geometric edge contours. Tree-based approximations of simple images that are smooth away from a smooth contour are not asymptotically optimal, while image coders tend to introduce "ringing" artifacts around edges. We introduce a modeling framework that can be interpreted either as: 1) a straightforward extension to the zerotree model that explicitly accounts for edge structure, or 2) a novel atomic representation that synthesizes images using wavelets and wedgeprints – anisotropic atoms that are well-suited to edge singularities. Using this model, we develop a prototype coder that has near-optimal R-D asymptotics $D(R) \sim (\log R)^2/R^2$ for the class of piecewise smooth images containing smooth C^2 regions separated by edges along smooth C^2 contours, and we refine the prototype into a practical, general-purpose image coder. (Received January 02, 2004)