An Alternate Technique for Noise Power Spectral (NPS) Measurements in Digital Radiography and Mammography

NPS measurements of digital systems pose many difficulties. The finite dimension of the slit is a major difficulty with the well known slit-synthesis technique. Further, computing two dimensional (2d) NPS is essential to characterize off-axis noise. Estimating 2d-NPS also poses a few difficulties. Since the "true" NPS is convolved with the $sinc^2$ function in the frequency domain, due to the finite window of noise data, choice of region-of-interest(ROI) size is important. Small ROI might remove or flatten the peaks in the "true" spectrum. Large ROI is preferred and when a large ROI is impractical, zero-padding might be a solution. The second difficulty arises from the need to average a large number of NPS realizations to obtain a smooth spectrum. The proposed technique addresses this difficulty and effectively obtains an accurate 1d-NPS from 2d-NPS. This technique radially averages the entire 2d-NPS avoiding data values on the axes. Since incomplete background trend removal can corrupt the spectrum, data values on the axes were avoided. For every (u,v), the frequency was computed as $sqrt(u^2+v^2)$. This technique was compared with other techniques using data from an amorphous silicon based full-breast flat-panel digital mammographic system and demonstrated an improved variance with minimal distortion of spectral shape. The variance of 1d-NPS using this technique improves with increasing ROI size. This technique provides a more reliable measurement of the detective quantum efficiency of digital radiographic and mammographic systems. Supported in part by NIH-NCI:R01CA59770.