THE SPATIAL CROSS-CORRELATION COEFFICIENT AS AN ULTRASONIC DETECTION STATISTIC

RAINA CEPEL

Dr. K. C. Ho & Dr. Steven P. Neal - Thesis Supervisors

ABSTRACT

In ultrasonics, image formation and detection are most commonly based on signal amplitude. Matched filtering is an amplitude independent approach, but requires accurate template estimation. In this work, we introduce the use of the spatial cross-correlation coefficient as an additional detection statistic. The correlation coefficients are calculated between A-scans digitized at adjacent measurement positions and can be formed into images that are similar to C-scan images. We also describe an approach for generating simulated acoustic noise with a spatial correlation coefficient distribution and maximum extreme value (MEV) distribution which matches those distributions for measured acoustic noise. Using the simulated acoustic noise, grain noise and noise-corrupted flaw signals are simulated under varying conditions to compare performance. The spatial cross correlation approach is found to outperform gated peak detection at low signal to noise ratios. When the *a priori* flaw signal prediction is inadequate, the correlation approach also outperforms matched filtering. Techniques to maximize the efficacy of the spatial cross correlation approach are suggested.