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Polar scans as a nonlinear acoustics tool

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Nonlinear acoustic wave response provides a powerful means of assessing material properties. One very interesting area of application is testing for material damage. While an undamaged material may have a very linear acoustic response, damage such as crack formation creates strong nonlinearity with acoustic excitation amplitude. Many nonlinear acoustics techniques for nondestructive testing analyze the harmonic content in the wave scattered from a crack. A planar c-scan can be used in conjunction with the nonlinear acoustics techniques to provide defect detection and imaging. Polar scans are a complementary technique for damage assessment which has not yet found application in nonlinear acoustics. In the polar scan, the sound field in the hemisphere around a material point is measured and plotted to display a unique signature of local material properties. This work provides initial investigations into the use of the polar scan technique in nonlinear acoustics by detection of the second harmonic.