AbstractID: 7950 Title: Vibro-acoustography: Speckle free ultrasonic imaging

In this paper, we describe the principles of an imaging technique that produces a map of the mechanical response of an object to a force applied at each point. The method uses ultrasound radiation force to remotely exert a localized oscillating stress field at a desired frequency within (or on the surface of) an object. Harmonic radiation force is produced by mixing two ultrasound beams of different frequencies at their focal point. The resulting radiation force occurs at the difference and the sum of the two frequencies. In response to this force, a part of the object vibrates. The size of this part and the motion pattern depend on object viscoelastic and reflection characteristics. The acoustic field resulting from object vibration at the difference frequency, which we refer to as ‘‘acoustic emissions,’’ is detected by a sensitive hydrophone and used to form the image of the object that represents magnitude or phase or frequency content of the signal at each point over a raster scanned region. This method benefits from the high spatial definition of ultrasound radiation force and high motion-detection sensitivity offered by the hydrophone. The images have no speckle and are of high contrast. We call this technique ultrasound-stimulated vibroacoustography (USVA). The method has been applied to imaging lesions in breast, detection of calcification in vessels, detection of brachytherapy seeds in prostate, and modal vibration of vessels.

Educational Objectives:

1) Understand radiation pressure
2) Understand vibro-acoustography
3) Understand possible applications of vibro-acoustography in Medical Imaging.