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Observation of Ultrasonic Pulses

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Ultrasonic pulses for diagnostic systems are usually produced by shock exciting a piezoelectric disc. This produces a stress wave packet in the form of a series of replicas of the exciting waveform. Associated with this packet are frequency components far higher than would exist for a packet of nearly sinusoidal waveforms. The actual frequency content of a diagnostic pulse has far-reaching consequences in terms of target resolution, accurate compensation for tissue absorption, and possible hazards.

Several methods exist for observing the fine structure of ultrasonic pulses. Some of the most attractive contactless methods involve the use of coherent light beams. The advantages of these methods include high sensitivity, fast response, the ability to work over large distances, small probing area, and non-interference with the observed surface. Common arrangements utilize a Michelson interferometer with either homodyne or heterodyne mixing of the probing and reference beams. The use of such systems will enable detailed investigation into the effects of dispersive attenuation and harmonic generation on beam profiles in tissue. This will lead in turn to optimisation of diagnostic pulses and beam shapes and their methods of production.