

NONINVASIVE MEDICAL DIAGNOSTICS & TREATMENT USING ULTRASONICS

Yoseph Bar-Cohen^a, Willem Grandia^b, and Robert Siegel^c,

a. JPL, Caltech (125-224), 4800 Oak Grove Drive, Pasadena, CA 91109-8099

b. President, QMI, 919 Sunset Drive, Costa Mesa, CA 92627

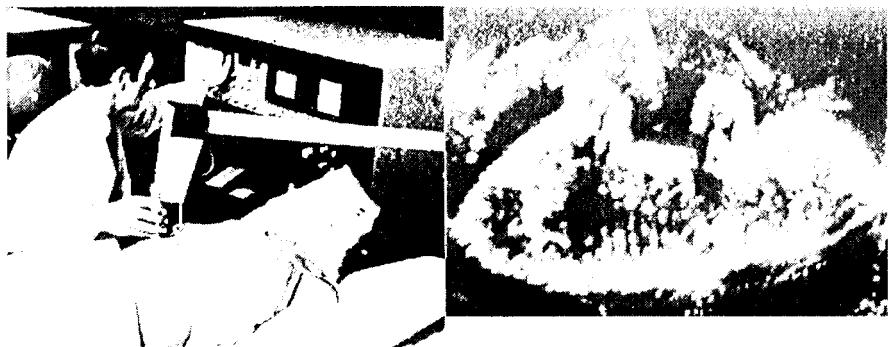
c. Cedars-Sinai Medical Center, Office 5335, 8700 Beverly Blvd., Los Angeles, CA 90048

INTRODUCTION

Noninvasive medical diagnostics and treatment tools are increasing effective choices of that are available to doctors and surgeons. Every part of the human body has already been explored with such tools and the reported success is very encouraging. With limited capability, visual and acoustic methods have been in use as diagnostic and NDT tools for hundreds of years. The introduction of such methods as radiography, MRI, magnetic field treatment and ultrasonics as well as computers and imaging devices made an innumerable impact on both fields. Ultrasound offers a wide range of possibilities and capabilities since the wave can be used in a broad frequency range, having variety of modes and can be operated in low and high power levels. Some of the most widely known applications are fetus imaging and kidney stones destruction. Medical ultrasonics offer safe, accurate and cost-effective tools, where no known health hazard is associated with its use at low power.

Ultrasonography has emerged as a medical diagnostics tool in the late 1960's and obstetrics has been one of the first applications. The most widely used techniques are pulse echo (3.5 to 7.0 MHz) and Doppler imaging (2 to 4 MHz). An example of a fetus imaging obtained in 1967 [1] is shown in Figure 1, where a doctor is shown (left) examining a pregnant woman and the fetus imaged is presented on the right. Currently used equipment offer real-time imaging, where the moving fetus is viewed on a color monitor. Pulse echo techniques are employed with the transducer coupled either in contact, immersion or using a liquid delay line. To obtain an instant image, transducer array is used and the reflected signals are being monitored. The sensitivity and resolution have been improved to a level that allows viewing even the movements of fetal heartbeat and to conduct accurate measurements on the monitor. Such measurements form the cornerstone in the assessment of gestational age, size and growth in the fetus. Ultrasonics has progressively become an indispensable tool for many medical diagnostic applications and it is already playing a key tool in the care of every pregnant woman.

Figure 1: A doctor testing a pregnant woman and a UT view of the baby.



Parallel to the industry use of

Internet to disseminate information about the use of ultrasonics, the medical community is forming homepages for this purpose and as an example see URL address

<http://www.rahul.net/intcc/sites.html>. To address ultrasonic medical issues, there is a society that is solely dedicated to this issue and it is known as the American Institute of Ultrasound in Medicine