USITutor™
for
Windows

Interactive Animated Tutorial for

Basic Principles of Ultrasonic Inspection

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24 March 2003

Topics

Installing and Running USITutor™

USITutor™ may be run from either the CD or transferred to a hard drive. Hard drive operation is best since it gives faster performance. AUTORUN will install USITutor™ to the hard drive, If AUTORUN does not activate, use START/RUN to select SETUP.EXE on the program CD.

System Requirements

Windows 95, 98, ME, NT, 2000 or XP. 32 MB Ram, CD-ROM and sound card are required

Selection of Learning Track
Persons new to ultrasonic inspection should enter USITutor™ using Track 1, the Introductory track. Level I and new Level II individuals should start with this track. The Introductory track contains all of the titles at the left except 7 - 9 and 15 - 18. Additionally, the videos are not available in the Introductory track. The Advanced track contains all of the topics as well as the videos. The user can freely switch from either track.

Moving About the Program
The first working screen shows the Vertical Navigation Bar and the General Information Screen. Any of the major topics can be selected by mouse clicking in the Navigation Bar as well as on the buttons at the bottom of the General Information Screen. Also, pressing RETURN will move vertically down through the Vertical Bar. The video may be stopped with the ESC button.

Working with a Topic
Several options are available from each screen. These typically deal with demonstration of motion, selection of parameters as well as selecting the video that is available from some of the screens.

Exercises, Text and Figures from the Video
The video is intended to provide advanced information, beyond the basic introductory material. While working with USITutor™, learning will be enhanced by separately printing and viewing the transcript and figures of the video. Also, some exercises with solutions are contained in the notes section. This material can be accessed from the About screen.

About
Several features are available in the About screen. Besides general information about the program, here you also can access the commentary text and the flaw detector screens used in the video. Additionally, there are some questions and exercises in the commentary text. Corrections to the audio text are placed as notes at the end of each segment.

Descriptive Notes

Dynamic graphics, interactive parameter selection and video with oral commentary and photos are used in this new version to provide a thorough instructional experience to supplement classroom or self-paced study. This Windows based tutorial program is based on the popular MS-DOS version of the same name. Topics covered include normal and angle beam pulse echo inspection as well as the operation of a typical flaw detector. Additional topics are pulse excitation, flaw echoes, A-scan and rectified and RF displays, and calibration. Longitudinal and shear waves, probe characteristics, pulse distortion, Snell's law, critical angles and the echo envelope are described. Selections made by the operator include probe frequency and diameter as well as a variety of materials. Elastic waves are covered from excitation to wave motion descriptions for longitudinal and shear waves. Pulse formation is described, as well as more complete explanations of pulse distortion and frequency analysis. Interactive demonstrations of beam divergence and pulse echo inspection are included for both normal beam and angle beam inspection. A fully functional ultrasonic flaw detector is the final sequence. Selection of introductory and advanced learning tracks and suggested exercises are included.

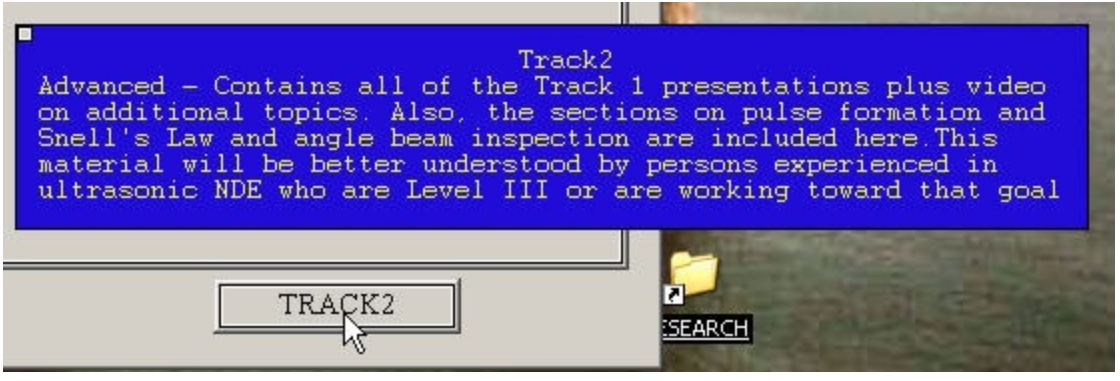
About the Author

Dr. Don E. Bray has worked in ultrasonic NDE for almost forty years, and taught engineering classes in ultrasonics at Texas A&M University for 22 years. In addition, he taught numerous short courses on the ultrasonics and other NDE methods. He is the co-author of the popular textbook Nondestructive Evaluation, CRC Press, Boca Raton, FL 1997. Material used in USITutor™ is derived from these instructional experiences.

Registration

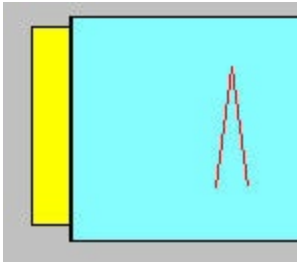
Purchasers are encouraged to register USITutor™ so that they may be informed of updates and other related information. The registration sheet on the CD may be completed and faxed or mailed to Don E. Bray, Inc.

Selected Highlights from USITutor™ **3/22/2003**

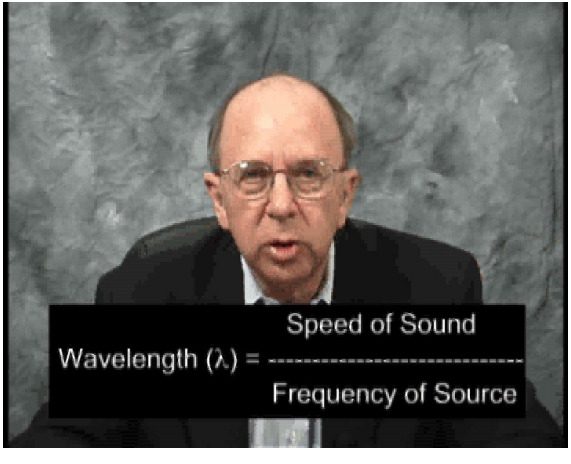


Placing the cursor over the buttons in many of the segments gives additional information on the topic.

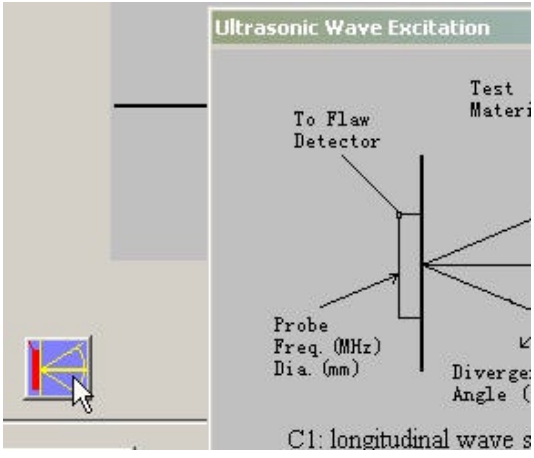
Clicking the video flag will activate the video lesson which supplements the topical segment where it is located.



Pulse excitation is demonstrated with a hammer strike on the end of the bar

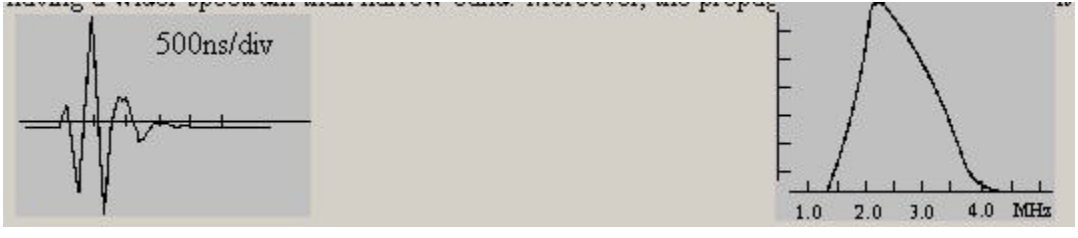


Importance of frequency and wavelength in ultrasonics is explained with examples.



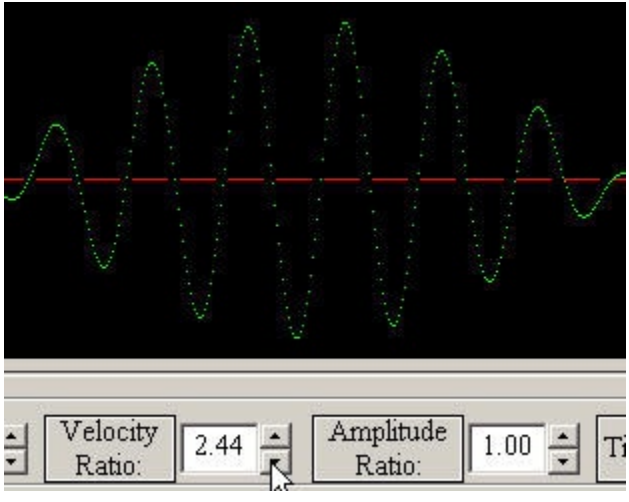
Beam spread button appears at several locations throughout the program.

This defines useful information on the probe and beam spread characteristics .

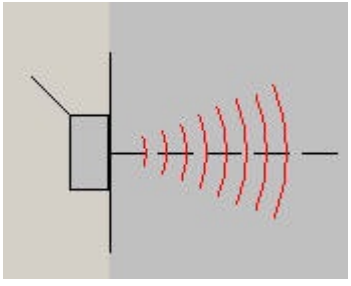


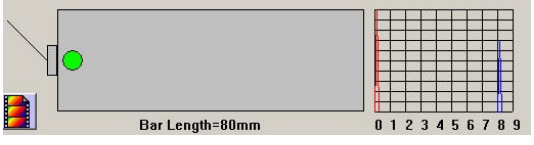
A nominal 2.5 MHz pulse (left) may or may not have a peak frequency of 2.5 MHz. In the spectrum on the right, the actual frequency is shown to be close to the specification. This is not always the case, and the characteristics of pulse formation and the varying frequency content is described.

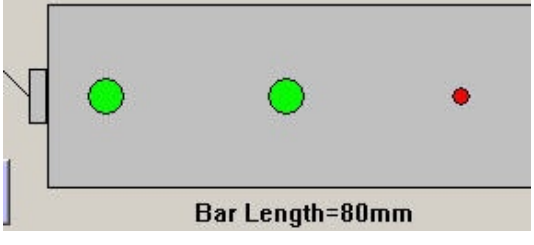
The effects of slight frequency, speed and amplitude differences on the pulse shape are demonstrated by changing these parameters in the program.



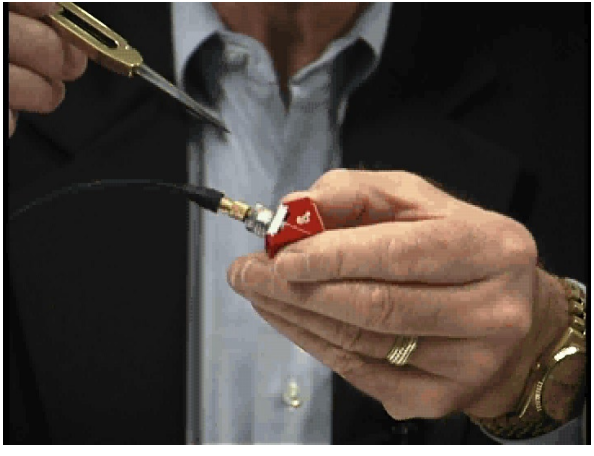
Clicking the probe diameter, frequency and the inspected material changes the beam spread angle.



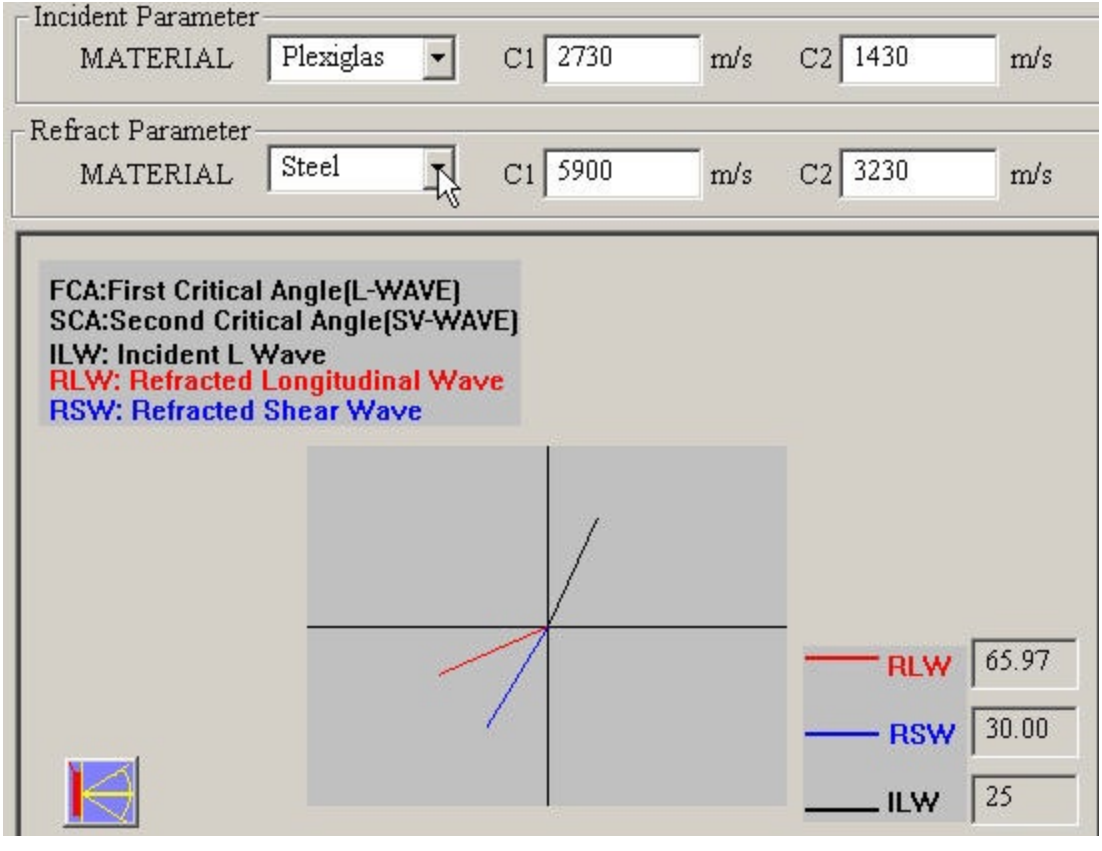




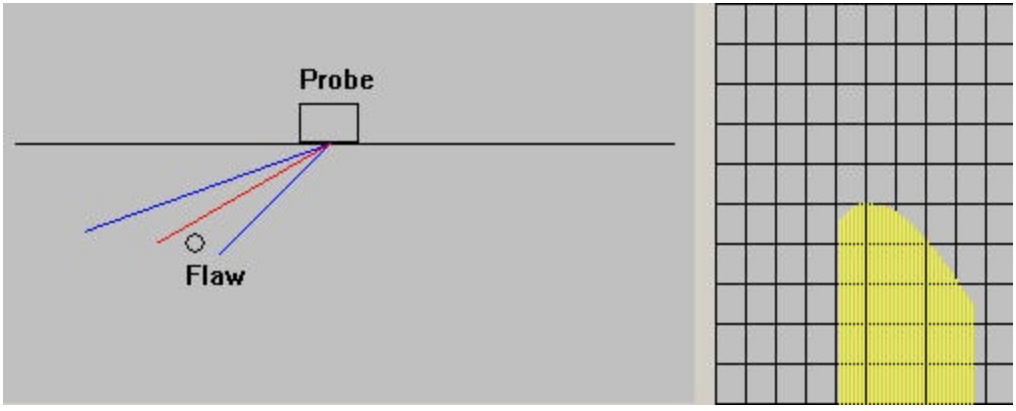
The energy burst (green sphere at the top left) travels through the material at a fixed speed. The thickness of the part is indicated by the location of the back echo. In the lower view, there are two energy spheres since one has bounced off of the bar end, and the other off of the echo flaw (red circle).



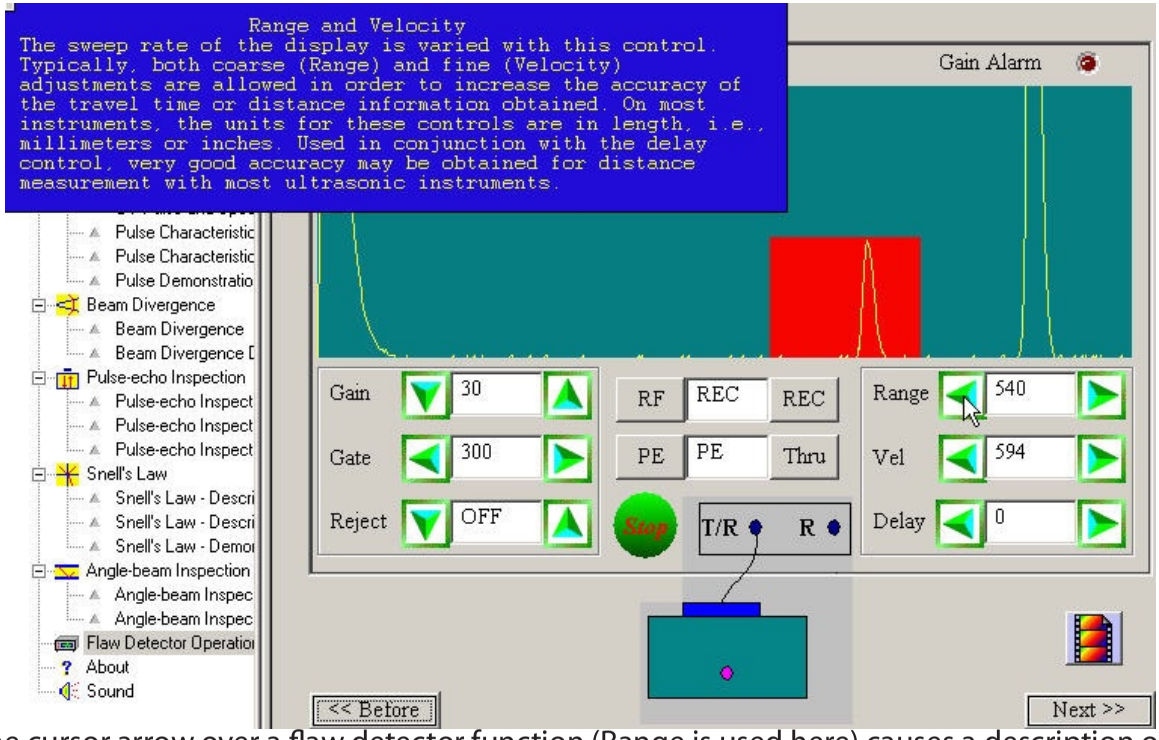
Angle beam probes are used to reach areas where normal beam inspection is either difficult or impossible. The characteristics and construction of the probe are described in this video.



The incident and refracting (inspected) materials may be varied and the refracted longitudinal and shear wave angles will be demonstrated as the incident angle goes from zero (normal) to ninety degrees.

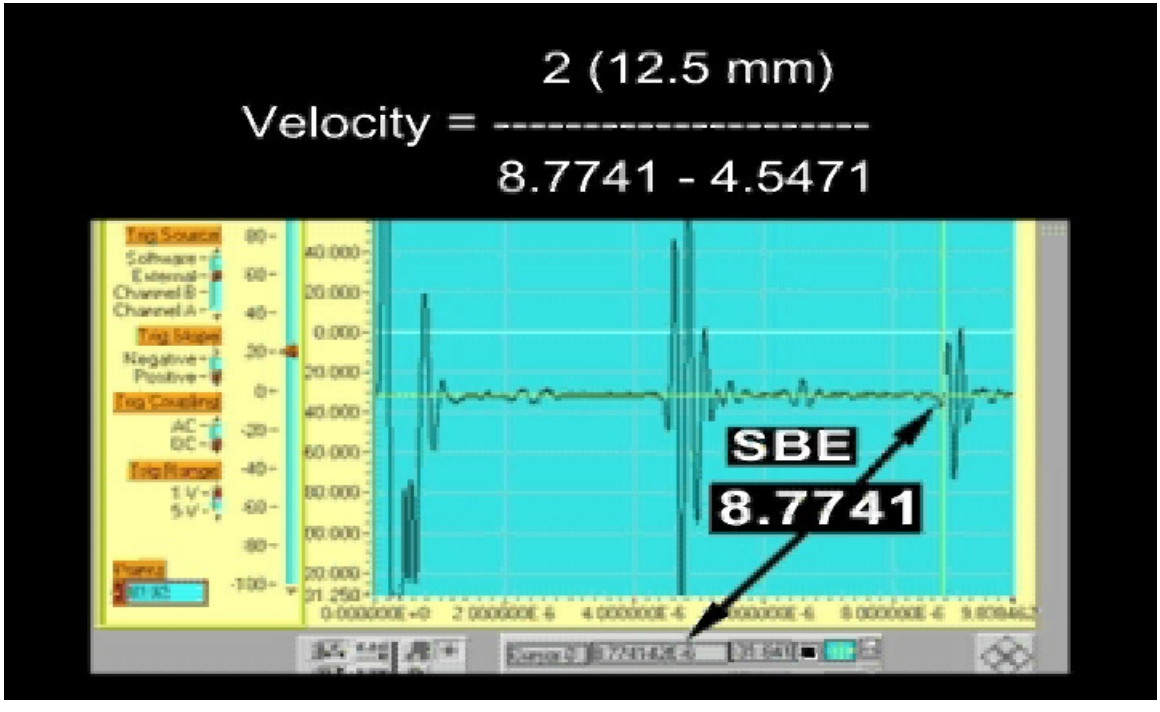


The probe shown above moves right to left and the echo envelope at the right is developed as the probe position moves.

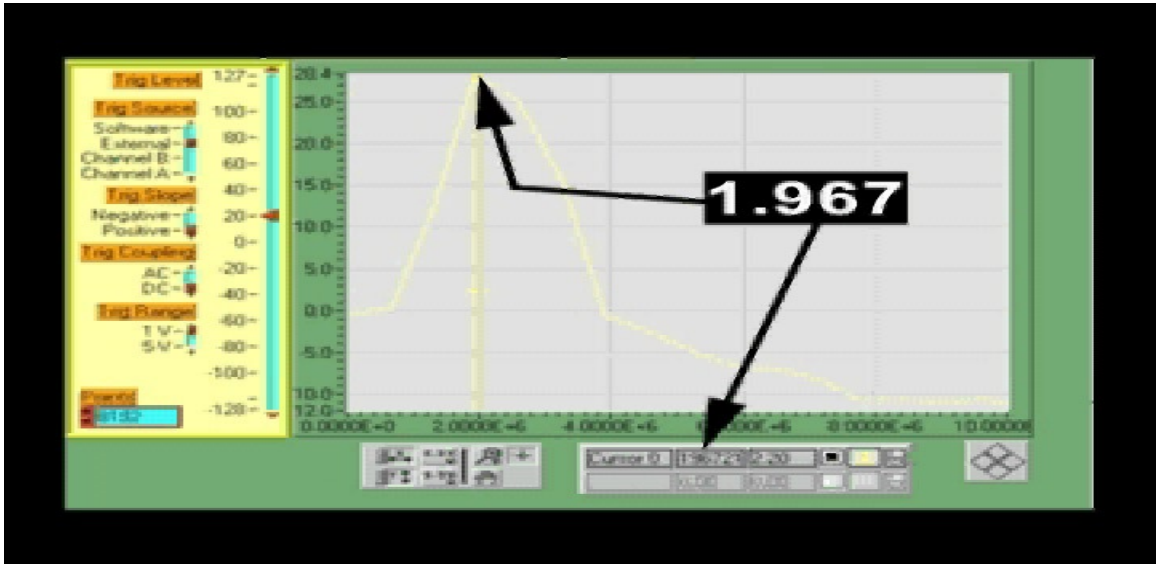


Placing the cursor arrow over a flaw detector function (Range is used here) causes a description of that function to appear. The values may be varied, simulating the operation of an actual flaw detector. OFF and ON is actuated at the STOP/START button

Step block thicknesses are described in preparation for demonstrations of ultrasonic principles.



Velocity is measured across the 12.5 mm thickness of the steel step block by obtaining the first back echo travel time (4.5471 µs not shown) and then the second back echo (SBE shown here). The 5914 m/s result is expected for steel.



Frequency analysis is a powerful tool in ultrasonic inspection. First, the true frequency of a probe may be checked. Also, various material properties such as stress cracking, inclusions and porosity affect the frequency, and these effects may be measured. Here the center frequency of 1.967 MHz is shown.