

5.1.19. NDE EDUCATION AND TRAINING FOR ENGINEERING AND ENGINEERING TECHNOLOGY PROGRAMS

Genis V., Lewin P.A., Berger W.A.,
Drexel University, Philadelphia, USA

Abstract: The purpose of this paper is to present an innovative approach to teach both theory and practical industrial applications of the Nondestructive Evaluation (NDE) of materials. There is a well-defined need for such training as the industry is becoming increasingly reliant on the NDE technology, which creates a growing demand for graduates familiar with this field. At the recent meetings of the American Society for Nondestructive Testing (ASNT), the employers constantly emphasized their urgent need for employees with knowledge and experience in the state-of-the-art computer-based data acquisition and analysis NDE systems. The NDE of materials course was developed for Applied Engineering Technology (AET) students at Drexel University's School of Technology and Professional Studies. This four credits, hands-on course consists of two parts: the first part stresses the foundations of ultrasound based NDE and the second part focuses on calibration and testing practice. Selected specific NDE applications are presented and discussed in-depth, so the students are gaining insight into the advantages and fundamental limitation of the NDE applications. Particular attention is given to detection and localization of discontinuities such as flaws, cavities, layers, and holes in different materials using state-of-the-art instrumentation. The students learn engineering practice and physical principles of measurements of sound velocity in different materials, attenuation coefficients, material thickness, and location and dimensions of discontinuities in a variety of materials. Laboratory sessions are carefully designed to complement the theoretical background presented to the students during classroom sessions. The course is designed to markedly improve the graduates' skills in the field of NDE utilizing portable ultrasound technology. Upon completion of the course the students undergo a final, comprehensive testing, which aids in their retention of acquired knowledge and testing skills. The course is primarily targeting the undergraduate AET students at the sophomore, pre-junior, or junior levels, however, both undergraduate and graduate Drexel students from other Colleges can enroll providing they comply with the mandatory set of prerequisites. The same acceptance procedure is applied to the students from other universities and community colleges.

Ultrasound NDE course.

In the following, a few selected ultrasound laboratory sessions are enumerated along with a brief description of the equipment used. Also, the requirements for students' deliverables, which provide the basis for grading of their work are presented. A brief conclusion, evaluating the outcome of the course is also given.

Laboratory sessions: During the weekly laboratory sessions the following experiments are implemented: 1. Calibration of automatic flaw detectors, 2. Evaluation of homogeneity of various materials used in industrial applications, 3. Detection and localization of discontinuities such as flaws, cavities, layers, and holes, and 4. Evaluation of shapes and dimensions of various discontinuities.

The students are performing the experiments using automatic flaw detectors USN 58L and USM 35X, which have different control features, operating with straight- and angle-beam probes. Examples of calibration results using a straight-beam probe are presented in Fig. 1.

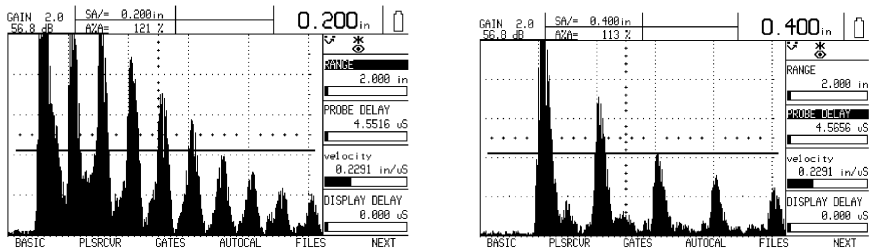


Fig. 1. Calibration of the flaw detectors using a straight-beam probe

Calibration procedure with the angle-beam probe using the International Institute of Welding type 1 calibration block is presented in Fig. 2A, and the results of the corresponding calibration using an angle-beam probe are presented in Fig. 2B, respectively.

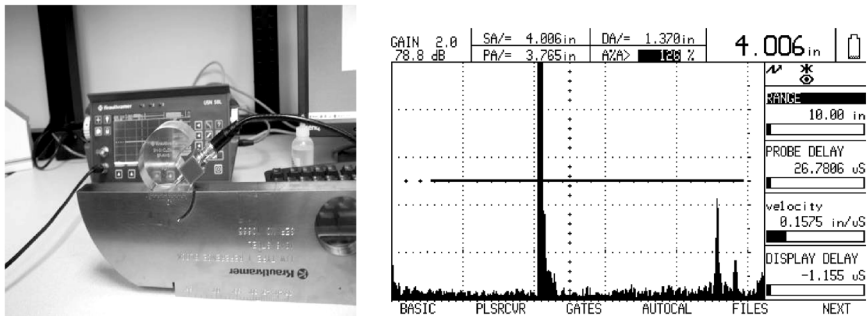


Fig. 2. A. Calibration setup using angle-beam probe and the International Institute of Welding calibration block for. B. Results of the calibration procedure using an angle-beam probe

Deliverables: The students are required to prepare and hand-in a comprehensive report mimicking the one they would be required to present in industrial practice. In addition to providing a succinct theoretical fundamentals, on which the specific ultrasound test is based, and presenting the experimental data, the students are required to include their own evaluation of the calibration and testing procedures. This evaluation includes assessment of the sources of errors and calculation of the overall calibration or measurement(s) uncertainty.

Conclusions: Upon completion of all laboratory sessions, the students are familiar with the basic ultrasonic instrumentation as used in industrial practice, and are capable of performing and documenting ultrasound NDE calibration and testing procedures.