



Book Reviews

Acoustic Emission. by R. V. Williams, Heyden & Son, Philadelphia, 1980, 140 pages. Price: \$29.00

Reviewed by H. Saunders¹

Acoustic emission is a bright star that always appears to be just on the horizon. It has popped its head in a number of different places. The most prominent are nuclear power plants, oil rigs, pressure vessels, and aircraft structures. There is a definite need for requiring the nondestructive testing (NDT) of such specimens during construction and service. Acoustic emission provides the safety checks for this modern, highly stressed equipment. Acoustic emission plays the role of an active guardian in checking nuclear power plants and oil rigs which require a 24 hour duty cycle per day, even under adverse conditions. However, acoustic emission does not provide the complete answer in critically monitoring the site under severe service conditions. It is one of the most powerful methods available to us in ensuring that the utmost in safety precautions of structures is enforced.

The author paints a vivid picture in a short compact volume. The book is a distillation of available information compiled from various publications, conference notes, and unpublished papers. The book may be considered as a novel rather than a deep scientific tome.

The monograph consists of eight chapters. The initial chapter introduces us to acoustic emission and presents some pros and cons on its application to the real world. The second chapter invites us to examine the various acoustic emission techniques including the various types of instrumentation. The transducers have a flat frequency response from 100 kHz to 1000 kHz coupled to a bandpass filter around 100 Hz wide. The author indicates that energy analysis is an effective method of differentiating between acoustic emission signals which have different frequency and damping characteristics. The author further discusses the various methods of signal analysis (an important feature of acoustic emission). The consequence of background noise is stressed since it is one of the limiting factors of the usefulness of acoustic emission. However, the author indicates how one may reject these misinformed noises and interferences.

Chapter three delves into acoustic emission and its relation to fracture mechanics. There are simple models which recount the plastic zone growth with the acoustic emission activity. The author points out the definite relationship between the definite metallurgical state and acoustic emission of the specimens. The concluding section of this chapter considers crack growth as monitored by acoustic emission, and their close relationship. The author then points out that a person

can employ acoustic emission to detect the presence and position of growing fatigue and stress corrosion cracks.

Chapter four dwells on the application of acoustic emission to pressurized components which consist of hydrostatic testing of pressure vessels, in-service surveillance of pressure vessels with special reference to stress corrosion cracks. Additional aspects consider the testing and determination of cracks in high pressure underground pipelines and leak detection in both pressure vessels and pipelines. Chapter five focuses on the welding process. The author stresses the importance of acoustic emission in checking the integrity of the welds during the process and upon completion. The execution of acoustic emission provides a great advantage over other NDT techniques i.e., ultrasonics and radiography during the welding process. The various current methods of welding, i.e. spot, arc, electron beam, and electro-slag, are reviewed. The acoustic emission methods are used in weld monitoring and determining the initiation of cracks in the process of welding a structure and its heat affected zones.

Chapter six considers off-shore structures. Acoustic emission replaces the various inspection devices i.e., divers, inspection from a submersible, and vibration monitoring. These conventional techniques are expensive and fraught with limitations. Acoustic emission has many advantages over other forms of NDT considering the wide area surveyed and real time nature of the method. It can detect any defect made active by the working loads imposed upon the structure, and its greatest advantage is its adaptability to remote continuous monitoring which other methods lack. It has found a good home in surveillance of oil rigs.

Chapter seven is brief and shows acoustic emission's application to aircraft structures. This is especially important in detecting cracks in hidden locations, between lap joints, under fastener heads as well as in inaccessible parts. The reviewer believes that one of its most important features is in determining the soundness of honeycomb structures. The concluding chapter considers acoustic emission in testing of fiber-reinforced materials and concrete.

The author has poured a great deal of information into this small compact volume. The greatest advantage is to the nonspecialist who could obtain a bird's eye view of the everyday applications of acoustic emission applied to engineering structures. The reviewer believes that this book should be expanded to incorporate more of the technical aspects of acoustic emission and detail it in more physical and mathematical terms. Although the references are ample, there is very little information regarding digital data reduction via spectral means. The reviewer believes this is a fertile field and will be the next important step in acoustic emission. The "state of the art" in the late 70's is presented in this novel book.

¹General Electric Co., Schenectady, N.Y. 12345