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Book Reviews

Non Destructive Evaluation-A Tool in Design, Manufacturing and Service

Edited by Don E. Bray and Roderic K. Stanley

In this age of spacecrafts, bullet trains and satellite communication, there is always a feeling of wonder and amazement at the progress that has been made in the last fifty years. This has been made possible because of advanced materials, computer integration and to a very large extent robotics. Very little is attributed to the improvement in safety standards, materials selection and materials testing. This has been accomplished mainly due to the progress made in the area of non-destructive evaluation. Unfortunately, there is a serious lack of literature in this area, though in recent years, new non-destructive evaluation (NDE) techniques, principles governing them and industrial application are published in journals and proceedings.

This book is a brilliant compilation of all the primary techniques used in this field: ultrasonics, magnetics, radiography, penetrants and eddy currents. The exhaustive list of NDE techniques have been divided into seven parts and thirty seven chapters. The introduction to the concepts behind these techniques are, simple and provided with suitable examples showing typical NDE applications of these principles. Some of the critical research issues and effect of such techniques on the environment have also been addressed.

Part I, introduces the reader to the use of NDE as a tool in design and manufacturing. The probabilistic approach towards detecting flaws, risk

factor, inspection optimisation and the rationale behind choosing proper techniques has been summarised. The importance of optimising costs and inspection techniques is based on the application of the component being tested. An interesting comparison is the non-destructive evaluation of a military aircraft and an elevator. The performance of both these utility machines should be extremely good, but it is noted that the costs towards inspection techniques for military aircraft are prohibitively high when compared to elevators. The approach towards cost and benefit analysis is answered by this observation, "Is an elevator more likely to fail than a military aircraft?" The book should address this issue in greater depths in order that the reader be appreciative of the differences in expenditure.

Each NDE technique is preceded by a section which gives a detailed description of the medium used for detection followed by mathematical derivations complimenting them. Ultrasonic technique (Part II) is explained by introducing principles of elastic wave propagation, incidence, wave length, wave speed and wave fronts. Similarly magnetic flux leakage techniques explained in Part IV are introduced to the reader with basic magnetism, lines of force, magnetic pole, flux density and magnetic moment. Penetrant techniques used in non-destructive testing require a prior knowledge of surface fluid

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mechanics, surface tension, capillarity and other material properties. These topics have been addressed in relation to the NDE technique in Part VI.

The other techniques which have been described at length are acoustic emission (Part III), which discusses fundamental topics such as characteristics of wave propagation, acoustic emission sources, sensors and their use in non destructive evaluation. Some of these principles have been researched in great details and supplemented with accurate figures and tables which confirm these findings. Eddy current (Part V) and radiography technique (Part VI) are introduced the same way as the other techniques, physics of eddy current and radiography, sources, and applications. In order to comprehend all the theoretical aspects, the reader should have a strong background in physics.

These non destructive evaluation techniques are currently being used in research and industry to ensure higher life times of machines and systems. This book provides the theoretical basis for these inspection tools, but it would still be extremely difficult for the reader to predict/choose the correct non-destructive evaluation technique for different

components. It can be easily recognised that this can be achieved by presenting a number of industrial examples or demonstrating the techniques, which is beyond the scope of the book. Though highly fundamental in its approach, this book contains some industrial examples, applications and problems and can be used as textbook for both undergraduate and graduate level courses. This book can serve its purpose better, if the non destructive evaluation techniques could be spread in two volumes, containing information about the fundamental laws of physics governing them, sources and their application in the industry. This book is also a useful addition to any library or a researcher actively involved in the area of non-destructive testing.

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