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Brief Overview of ASCE-Related Fatigue Studies in USA

Bref aperçu des études sur la fatigue aux USA en relation avec l'ASCE

Kurze Übersicht der Studien über die Ermüdung in den USA in Zusammenhang mit dem ASCE

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SUMMARY

The paper presents a review of ASCE participation in fatigue studies and some comments are made on the current U.S. fatigue research activity nationally. Future needs, directions and possibilities for research are also discussed.

RESUME

L'article donne un aperçu de la participation de l'ASCE aux études sur la fatigue et fait quelques remarques au sujet des recherches sur la fatigue actuellement en cours aux USA. Besoins futurs, orientations et possibilités pour la recherche sont également discutés.

ZUSAMMENFASSUNG

Der Artikel gibt einen Überblick über die Teilnahme des ASCE in Ermüdungsuntersuchungen und macht einige Bemerkungen über die laufende aktuelle Ermüdungsforschung in den USA. Zukünftige Bedürfnisse, Richtungen und Möglichkeiten der Forschung werden diskutiert.



INTRODUCTION

This author has been appointed as the official representative of the American Society of Civil Engineers (ASCE) to the IABSE Colloquium on "Fatigue of Steel and Concrete Structures", and this brief overview is made to acquaint the readers with the status of fatigue studies in the United States. The task is made difficult by two factors : 1) the author is not a specialist in the study of fatigue problems, and 2) the ASCE is not the main focus of research in this field in the U.S. However, in such a Colloquium where experts from around the world come to share the results of their special efforts, it may be interesting to see how an outsider views the field.

ASCE COMMITTEE ACTIVITIES

There are two committees specifically charged with fatigue studies within the ASCE technical committee structure ; both are part of the Structural Division :

- 1) Fracture and Structural Fatigue (within the Technical Committee on Metals) ; chairman Prof. Pedro Albrecht.
- 2) Fatigue and Fracture Reliability (within the Technical Committee on Structural Safety and Reliability) ; chairman Prof. Paul Wirsching.

Total membership of the two committees is 40, with a ten percent overlap in members. The primary function of ASCE technical committees is dissemination of current information (conference sessions, papers and State-of-the-Art reports), stimulation of research, and implementation in design practice. The main difference between the two ASCE fatigue committees is one of emphasis : one is concerned with all aspects of metal fracture and fatigue, especially the evaluation of the test data in order to develop design methods, while the other is involved in the development of



probability-based design and analysis methods. Such committees are a good thing, representing the mature stage of development (education, evaluation, codification, etc.), but they are not, as a group, on the cutting edge of research even though individual members themselves are operating at that level.

RECENT ASCE PAPERS ON FATIGUE

A review of the ASCE Publications Abstracts for the period 1978 through 1981 revealed the rather small number of 25 papers, indicating that ASCE is not a very active outlet for fatigue and fracture studies. Nine of the papers dealt with experimental investigations, the remainder being about equally divided between general papers, design methods, theoretical analyses (including three papers on reliability topics), and evaluations of specific field failures.

RESEARCH DIRECTIONS

Looking as a relative non-expert on the scene of fatigue and fracture research in the U.S., it would seem that far too little effort is being extended on these problems for civil engineering structures. Considering the sophistication of the analytical techniques which are available, the importance to our economy to solve the problems, the availability of advanced laboratory and field testing equipment, and the advances made in other fields (e.g., aircraft and machine design), it appears that more should be done. To be sure, work is going on on fatigue problems which have occurred in real structures, and there is fundamental research being conducted on corrosion fatigue and on various details and materials pertinent to bridges and off-shore platforms. An exciting area of research which has as yet received far too little application in fatigue and fracture is the use of the methodology



probability-based design. Some efforts in this direction are underway, but support for such work seems to be inadequate. In the opinion of this author, fatigue and fracture research for civil engineering structures on both the fundamental and the applied side is grossly underfunded, resulting in a possible decline in solutions to many of our pressing engineering problems.

However, it is not necessary to base this paper on a pessimistic note. Traditional research on fatigue has, is, and will continue to provide basic data on various materials and details with which we are concerned. This is important work and should continue, but in a new direction : to provide meaningful data for use in methodologies of design yet to be completely defined. Many possibilities for these analytical methods are being investigated from various points of view : first-order, second-movement probabilistic methods, various approaches involving ideas of damage, and the just evolving methodologies using fuzzy logic. In the opinion of this author it is imperative that first a commonly agreed upon rational model, or a set of interrelated models, be developed and tested for use in solving fatigue and fracture problems. Laboratory and field research should then be performed to provide the necessary data so that the models can be implemented for use in practice. While such a scheme is not formally operative at present, there are still a number of developments underway which leads to the hope of the emergence of a rational and consistent method in the near future.