

# **PROBABILISTIC ASPECTS OF FATIGUE**

*R. A. Heller, Editor*

**STP 511**



**AMERICAN SOCIETY FOR TESTING AND MATERIALS**

# PROBABILISTIC ASPECTS OF FATIGUE

A symposium  
presented at the  
Seventy-fourth Annual Meeting  
AMERICAN SOCIETY FOR  
TESTING AND MATERIALS

Atlantic City, N. J., 27 June – 2 July 1971

ASTM SPECIAL TECHNICAL PUBLICATION 511

Robert A. Heller, symposium chairman

List price \$19.75  
04-511000-30

AMERICAN SOCIETY FOR TESTING AND MATERIALS  
1916 Race Street, Philadelphia, Pa. 19103

© BY AMERICAN SOCIETY FOR TESTING AND MATERIALS 1972  
Library of Congress Catalog Card Number: 72-75900

NOTE

The Society is not responsible, as a body,  
for the statements and opinions  
advanced in this publication.

Printed in Baltimore, Md.  
July 1972

## Foreword

The Symposium on Probabilistic Aspects of Fatigue was presented at the Seventy-fourth Annual Meeting of ASTM held in Atlantic City, N. J., 27 June-2 July 1971. The sponsor of this symposium was ASTM Committee E-9 on Fatigue. Robert A. Heller, Virginia Polytechnic Institute, presided as symposium chairman.

## **Related ASTM Publications**

**Fatigue at High Temperatures, STP 459, (1969),  
\$11.25**

**Effects of Environment and Complex Load History  
on Fatigue Life, STP 462, (1970), \$22.00**

**Manual on Low Cycle Fatigue Testing, STP 465,  
(1970), \$12.50**

# Contents

Introduction	1
New Method for the Statistical Evaluation of Constant Stress Amplitude Fatigue-Test Results— <i>F. A. Bastenaire</i>	3
Estimating the Median Fatigue Limit for Very Small Up-and-Down Quantal Response Tests and for <i>S-N</i> Data with Runouts— <i>R. E. Little</i>	29
Regression Models for the Effect of Stress Ratio on Fatigue-Crack Growth Rate— <i>B. Mukherjee and D. J. Burns</i>	43
Comparison of Scatter under Program and Random Loading and Influencing Factors— <i>G. H. Jacoby and H. Nowack</i>	61
Investigation of Fatigue Life and Residual Strength of Wing Panel for Reliability Purposes— <i>Sigge Eggwertz</i>	75
A Reliability Approach to the Fatigue of Structures— <i>A. O. Payne</i>	106
Discussion	150
Random Fatigue of 2024-T3 Aluminum Alloy under Two Spectra with Identical Peak-Probability Density Functions— <i>R. C. Linsley and B. M. Hillberry</i>	156
Application of the Monte Carlo Technique to Fatigue-Failure Analysis under Random Loading— <i>H. Itagaki and M. Shinozuka</i>	168
On the Probabilistic Determination of Scatter Factors using Miner's Rule in Fatigue-Life Studies— <i>S. C. Saunders</i>	185