

# CONTENTS

|                                                                                                                                                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Introduction                                                                                                                                                       | v   |
| Society of Environmental Engineers                                                                                                                                 | vi  |
| List of symbols                                                                                                                                                    | vii |
| <b>Session I. Cyclic deformation and the early stages of fatigue</b>                                                                                               |     |
| The evolution of fatigue crack initiation life prediction methods.<br><i>JoDean Morrow and Darrell F. Socie</i>                                                    | 3   |
| Mechanisms of fatigue crack initiation in a Ti-6Al-4V alloy.<br><i>R. Brown and G. C. Smith</i>                                                                    | 22  |
| Fatigue crack initiation mechanisms in pure polycrystalline iron.<br><i>R. Dulniak, F. Guiu and B. C. Edwards</i>                                                  | 33  |
| Fatigue crack initiation and growth in gray cast iron.<br><i>J. W. Fash, D. F. Socie and E. S. Russell</i>                                                         | 40  |
| Consideration of gross plasticity in approximative calculations of local stress strain behaviour — an experimental verification.<br><i>P. Heuler and T. Seeger</i> | 52  |
| Improving the thermal fatigue resistance of brake discs.<br><i>N. Sykes, C. Musiol and J. M. Draper</i>                                                            | 60  |
| <b>Session II. Fundamentals of fatigue crack growth</b>                                                                                                            |     |
| SCC crack growth under vibratory stress of high R values.<br><i>K. Endo, K. Komai and K. Minoshima</i>                                                             | 77  |
| Hydrogen enhanced fatigue crack growth behaviour of high strength steels.<br><i>K. Hirano, Y. Kobayashi, H. Kobayashi and H. Nakazawa</i>                          | 87  |
| The effect of cold rolling on the fatigue properties of a SAE 1010 steel.<br><i>L. Legris, M. H. El Haddad and T. H. Topper</i>                                    | 97  |
| Fatigue crack growth at low stress intensities.<br><i>J. K. Musuva and J. C. Radon</i>                                                                             | 106 |
| The use of electron optical techniques in the study of fatigue in high strength aluminium alloy 7010.<br><i>K. J. Nix and H. M. Flower</i>                         | 117 |
| <b>Session III. Applying fatigue crack growth models</b>                                                                                                           |     |
| Similitude and anomalies in crack growth rates.<br><i>David Broek and Brian N. Leis</i>                                                                            | 129 |
| The influence of austenite stability on fatigue crack growth retardation.<br><i>Y. Katz, A. Bussiba and H. Mathias</i>                                             | 147 |
| Fatigue crack propagation under periodic oversteering.<br><i>R. Koterazawa</i>                                                                                     | 159 |
| Application of fracture mechanics to structural weldments of A514 steel.<br><i>Ashok Saxena</i>                                                                    | 170 |
| <b>Session IV. Fatigue of non-metallic materials</b>                                                                                                               |     |
| Fatigue crack propagation characteristics in engineering polymers.<br><i>Richard W. Hertzberg and John A. Manson</i>                                               | 185 |
| Fatigue delamination in unidirectional carbon-epoxy composites.<br><i>F. X. de Charentenay, K. Kamimura and A. Lemasçon</i>                                        | 199 |
| The fatigue of polymeric textile fibres.<br><i>J. W. S. Hearle and I. E. Clarke</i>                                                                                | 210 |
| Energy for crack growth in laminates.<br><i>G. J. Lake</i>                                                                                                         | 223 |

|                                                                                                                                                                                      |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Fatigue resistance of natural rubber in compression.<br><i>P. B. Lindley and A. Stevenson</i>                                                                                        | 233 |
| Characteristic damage states: a new approach to representing fatigue damage in composite laminates.<br><i>K. L. Reifsnider and A. Highsmith</i>                                      | 246 |
| Root bending fatigue and cyclic thermal softening of acetal thermoplastic spur gears.<br><i>H. Yelle, S. S. Yousef and D. J. Burns</i>                                               | 261 |
| <br><b>Session V. Life prediction, including environmental effects</b>                                                                                                               |     |
| Evaluating the effect of residual stresses on notched fatigue resistance.<br><i>H. S. Reemsnyder</i>                                                                                 | 273 |
| Generation of fatigue load spectra from recorded flight data.<br><i>A. G. Denyer and D. P. Maynard</i>                                                                               | 296 |
| Effect of mean stress on cumulative damage under service loadings including stresses below the fatigue limit.<br><i>M. Kikukawa, M. Jono and Y. Murata</i>                           | 308 |
| A fractographic approach to the influence of a single peak overload on fatigue crack growth.<br><i>Hideo Kobayashi, Haruo Nakamura, Akihiko Hirano and Hajime Nakazawa</i>           | 318 |
| Determining the reliability of some load-carrying motor-cycle components using full-scale fatigue testing equipment to service-loading.<br><i>M. Kopecky</i>                         | 328 |
| Application of combined static and fatigue crack growth data in structural assessment.<br><i>D. Rhodes, L. E. Culver and J. C. Radon</i>                                             | 337 |
| Flight simulation fatigue crack propagation in single and double element lugs.<br><i>R. J. Wanhill, A. A. Jongebreur, E. Morgan and E. J. Moolhuijsen</i>                            | 349 |
| <br><b>Session VI. Testing, and the interpretation of laboratory and field data</b>                                                                                                  |     |
| Fatigue data for design applications.<br><i>E. Haibach</i>                                                                                                                           | 365 |
| Scatter in fatigue life — a materials, testing and design problem.<br><i>J. Y. Mann</i>                                                                                              | 390 |
| Corrosion fatigue crack propagation behaviour of HT 80 in 4°C sea water.<br><i>R. Ebara, H. Kino, S. Nakano, M. Hanzawa and H. Yokota</i>                                            | 424 |
| The effects of small defects on the fatigue strength of hard steels.<br><i>Y. Murakami and T. Endo</i>                                                                               | 431 |
| A system for carrying out fatigue crack propagation tests under superimposed hydrostatic pressure.<br><i>P. J. Ross, W. J. Plumbridge and J. S. C. Parry</i>                         | 441 |
| Analysis of fatigue crack growth data for various steels with special reference to fracture mechanisms and metallurgical structures.<br><i>K. Tanaka, C. Masuda and S. Nishijima</i> | 450 |
| A theoretical study on the fatigue life distribution of metallic materials.<br><i>T. Tanaka and T. Sakai</i>                                                                         | 461 |
| Effects of preloading, unloading and stress ratio on the fatigue crack threshold of maraging steel.<br><i>S. Usami and H. Kitagawa</i>                                               | 472 |