qual moduli in tension and compression. The final paper in this group deals with nonlinear multi-mode response of clamped rectangular plates subjected to applied acoustic loading.

The initial paper of Group (j) reports on the response of fibrous concrete to seismic loading. This follows with inelastic analysis applied to highway bridges. The last paper describes the elastic response of rooftop frames subjected to distributed and concentrated shock load.

Group (k) deals with random vibration. The initial paper is an excellent review of random vibration research from the mid 60s to early 80s. The next paper deals with closed-form solution of Timoshenko beam subjected to random vibration input. The last paper covers the random vibration of discrete, periodic coupled frame-well systems when subjected to wind and earthquake inputs. This is applied to particular types of tall buildings.

Groups (k) and (l) consider road and rail vehicles. The initial paper in the former group focuses on the vehicle and its nonlinear suspension properties. The second paper deals with a state space approach to the analysis of nonstationary, nonlinear inputs under vibration applied to rough ground or road tracts. The initial paper in group (l) considers the dynamic modeling of railway track and sets of wheels and its resultant consequences. The next paper encompasses wave propagation in rails. The third paper deals with dynamics and stability of train track systems. The fourth paper contributes an assessment of the generating mechanisms and its forced response on wheel/rail noise via rolling disk. The last paper concentrates on the acoustically optimal design of railway vehicles.

The next group centers around aerospace structures and fatigue. The initial paper of this group reviews work performed by JPL groups on the Galileo spacecraft. They mentioned that random input provides more modes than the sine dwell test. Cross-orthogonality shows that for some modes, there can be a substantial disagreement. The next two papers deal with a good review of fatigue life of adhesive bonded structures subjected to acoustic loads, plus the acoustic fatigue of stiffened composite structures. The next two papers cover the sonic fatigue design model for the response of carbon-fiber reinforced plastic skin-stringer panels and predict the dynamic properties of carbon-fiber sandwich hybrid laminated composites. The last paper deals with the life time prediction of a tennis racket by finite element and modal analysis data.

Group (o) reports on machinery, and the initial paper covers the noise energy radiated from the drill rods of a rock drilling machine. The author indicates that the next types of drill rods are more efficient in controlling the noise levels. The second paper employs a scale model in investigating the noise and vibration of a 200-t power press in operation. Suggestions are furnished as to modifications of tooling, sheared punches or reduced punch/die clearances for noise reduction. The third paper considers active force control in reducing machinery noise. The last paper presents the relationship between structural vibration and radiated sound. This is accompanied by an excellent corroboration of theory via experiments.

The final group centers on damping. The first paper provides a terse description of an all-inclusive directory in many of its directions. The next paper furnishes the recipe for a number of mathematical models for internal damping. The final paper deals with the determinations of the receptances of a nonclassically damped structure from these undamped counterparts.

This is an excellent symposium. The use of modern high-speed computers and advanced types of testing has pushed structural dynamics to an exalted position. In this symposium, nonlinear vibration occupies a prominent position. The reviewer was disappointed that no acoustic papers were presented. Other areas of interest that were missing are fluid-structure interactions, mechanical signature analysis, and probabilistic methods in structural dynamics and fracture mechanics. Perhaps in the future, these topics will be included. The reviewer highly recommends this symposium to those interested in structural dynamics.


This is a unique book! In the operation and design of a number of high-temperature engineering plants the possibility of fatigue failures must be considered. Cyclic loads arising from temperature cycles and other mechanical sources are inherent in the design of steam and gas turbines, nuclear reactors, and selected chemical plants. This must be factored into the design of critical components in order to possess acceptable fatigue lives. These design procedures rely on systematized methods or codes. They in turn are based on imposing rules and procedures on test findings. High-temperature fatigue process is further complicated by time-dependent phenomena, i.e., creep, environmental effects, and metallurgical changes in structures due to aging of the material. Experimental study of high-temperature fatigue plays an important role in the proper underlying design principles. The two most important aspects are (a) a requirement for adequate range of fatigue data for the materials and the conditions to meet the basic design requirements of high-temperature design method or code; (b) experimental study of high-temperature fatigue process and proper interaction with time-dependent phenomena in order to comprehend the operational mechanisms.

The book consists of 10 chapters.

Chapter 1 examines the extensometer–specimen interface as primarily applied to power plant industries. To simulate the temperature and mechanical strain cycles in a controlled fashion in a test requires increased difficulty in testing under isothermal conditions. A careful study of the specimen extensometer must be made.

The specimen shape may be either (a) straight cylindrical gage length, (b) hourglass, or (c) solid versus hollow cylinder and must be properly aligned. The next important aspect is extensometry as required for measurement of important signals for closed loop strain control. A number of important features as to location and resolution of continuous extensometer readings are important. The various types of extensometers are axial and radial. An additional extensometer is the diametral type. The calibration of extensometers are extremely important and should be done with care. The next topic is isothermal creep-fatigue tests and thermo-mechanical strain tests. Here the temperature is cycled either in- or out-of-phase with the applied mechanical strain applied in a completely controlled fashion with fast response. The author provides helpful suggestions to temperature tests in the range of 750°C to 1000°C.

Chapter 2 continues with side contact axial extensometry. A review is made of the available and most applicable strain measuring methods for high-temperature testing. The different versions of side contact axial extensometers are explained with actual application and description of the latter as employed at the Risby Nuclear Lab (RNL) in England. A most interesting chapter!

The next chapter reports on axial extensometry for ridged specimens. The described methods furnishes a viable means of determining low-cycle fatigue and creep fatigue properties of Ni-Cr based super-alloys at high temperatures. Also, it is shown that under test conditions the effect on the stress concentration in the vicinity of the ridge is small in the high-strength superalloys. Also, this shows a substantial stable
cyclic stress-strain behavior. Chapter 4 focuses on strain measurement in high strength anisotropic materials. The experimental problem of measuring strain and determining the life to failure concurrently has not been fully resolved. Hourglass specimens and diametral extensometry lead to small ratios of materials being tested. It is further doubtful if any one technique for strain measurement has universal applicability, i.e., different materials and circumstances favor different solutions. When employing a computer for data application, extreme care must be taken in order that one does not oversimplify the assumptions, i.e., regarding equipment characteristics and material behavior.

Chapter 5 describes heating methods and grips. The heating techniques for high-temperature testing are reviewed. The split muffle furnace and the split radiant furnace are recommended for general use. This includes the commercial availability of test sections with or without extensometers. Radio frequency heating and direct electrical heating are useful, but care must be used in high-temperature testing. Grip design must also be selected with care when used in the high-temperature environment. However, by combining a number of good features from various designs, plus a proper selection of the appropriate materials, grips may be designed to meet the specific needs of a particular test program.

Chapter 6 reports on the use of reverse bending tests. The simplest and most reliable experimental approach in generally long-term high strain fatigue for steam turbine design is reverse bending. Accurate cyclic stress-strain data can not be obtained from reverse bend tests. Complementary short-term push-pull tests are necessary. Comparative evaluation of the reverse-bend and push-pull tests conditions suggest that neither is inherently preferred to represent the condition at a strain concentration in a service component.

The next chapter discusses high-temperature fatigue testing in inert environments. Fatigue testing in a vacuum chamber is important for the following: (a) there is general cleanliness in a chamber; (b) the rate of gas flow is appropriately monitored at the required level; (c) crack propagation rate is simulation of the behavior of internal defects in a high-temperature plant; (d) crack growth steps are identified; striation formation is suppressed, which provides clean fracture surface. The different types of vacuum chambers both here and abroad plus their important application to fatigue testing and reviewed. The measurement of strain and its proper control can be performed by remote attachments or direct attachment. The concluding section indicates the greater endurances can be accomplished in vacuum test when compared to air tests.

Chapter 8 covers the onset of cracking and failure, critical in high strain fatigue. The three main methods considered are load drop, modulus variation, and d-c potential drop. All indicate the cracked area only. Supplementary evidence is required to determine crack shape. The main crack area determined by load drop or modulus variation changes is 1.5 percent of the specimen cross-sectional area. Chapter 9 discusses the application of microcomputers in fatigue testing. The microcomputer an RNL has paid for itself many times. Previously the idea of supplanting the measured collection of data from test machines was to reduce boredom and labor. The “brownie” points are (a) east of control and evaluation of data from a multiple number of test machines, (b) immediate availability of data from test in progress as to point out results, and (c) monitoring of screen display. In addition, the various graph plotting, routines, speed and accuracy plus the ability to derive best-fit curves for test data are also very useful. This also considers the superimposing of test data when required.

The last chapter focuses on the application of microcomputers in creep fatigue testing. The generated signal (data logging system) based on a microcomputer has been successfully used in the operation of servo-hydraulic creep fatigue machines. The success of the microcomputer relies upon the careful study of the level of performance required to carry out the experimental program plus the availability of suitable interface devices and on whole, the overall flexibility of the system.

In summary, this is a good book. There are very few books of this caliber on the market which take us behind the scenes in actual testing. Although high-temperature testing has been performed for years, its most productive period has been in the last 20 years. The reviewer recommends this book and it should be required reading for those interested in high-temperature testing and the accompanying data acquisition.