

COMPUTER SHOCK AND VIBRATION CONCERNS

By Tom Irvine

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INTRODUCTION

Digital microcomputers are ubiquitous.

Computers inside the space shuttle control its descent from orbit until it slows to Mach 1, the speed of sound. At this time, the pilots gradually take over control and prepare for landing.

Computers inside satellites provide a myriad of functions. For example, a satellite computer might record sensor data for later transmission to Earth ground stations. Computers with analog-to-digital conversion modules are replacing strip chart records for seismic monitoring.

Obviously, computers are becoming increasingly common in home and business settings, where they are used for calculations, word processing, data storage, Email, internet access, and entertainment.

Computers and other electronic equipment must withstand shock and vibration environments during assembly, shipping, and at other times. Computers must also function accurately during shock and vibration exposure. For example, the space shuttle computers must accurately control the vehicle while it undergoes the aerodynamic buffeting from re-entry into the atmosphere.

The purpose of this report is to give some design, testing, and analysis guidelines for computers with respect to shock and vibration environments.

EXPECTED ENVIRONMENTS

Notes

Design engineers must understand the shock and vibration environments to which their computers will be exposed. A few examples are given in this section.

Assembly

Power screwdrivers are often used to install components inside computer chassis. These screwdrivers produce bursts of pulses having high amplitudes and very short duration. Hard disk drives may be particularly susceptible to these shock pulses. The International Disk Drive Equipment and Materials Association (IDEMA) addresses this concern in Reference 1.

Transportation and Shipping

Transportation and shipping environments are a concern for all computers. For example, a computer might be shipped inside a truck that runs over potholes and railroad tracks at imprudent speeds.

A well-designed shipping container with foam inserts should be able to reasonably protect a computer from shock and vibration. Packaging techniques are discussed later in this report.

Motor Vehicles

Some computer systems must be permanently mounted in vehicles. These systems must operate during the shock and vibration. For example, computers in emergency rescue vehicles must function accurately even when the vehicles travel on washboard roads. The author has experience measuring washboard road vibration. Most of the energy was in the 0 to 20 Hz frequency range. A notebook computer data acquisition system was used to measure the acceleration. Ironically, the computer suffered hard drive lock up problems during the worst of the vibration.

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Shock Vibration Computer Programs Revi

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The Shock and Vibration Digest, 1988 *Track/Train Dynamics and Design* Gerald J. Moyer, Walter D. Pilkey, Barbara F. Pilkey, 2013-10-22 Track Train Dynamics and Design Advanced Techniques reviews the progress that has been made in the development and applications of advanced analytical techniques for improving the dynamic stability safety and reliability of current generation rail freight vehicle components and track structures Topics covered range from structural mechanics and stress analysis methods to and material science techniques for the prediction of fracture and wear in railroad applications The nature of technology transfer from other application areas notably aerospace is considered along with the unique nature of some railroad problems This book is comprised of 26 chapters and opens with an overview of Phase II of the Cooperative Track Train Dynamics Program including its main goals tasks and progress The reader is then introduced to the state Of the art of rail analytical techniques and cost benefit issues associated with railways and railroad transportation The following chapters explore body centerplate fatigue cracking mathematical models for track train dynamics wheel and rail wear during freight car curving and application of advanced stress analysis techniques in the design of freight car components The application of finite element analysis to the study of railroad wheel failure phenomena is also outlined This monograph will be a useful resource for transportation and mechanical engineers especially those dealing with railroads **Scientific and Technical Aerospace Reports**, 1976 **Applied Mechanics Reviews**, 1974 **Introduction to Hydrocodes** Jonas Zukas, 2004-01-20 A hydrocode refers to a computer program used for the study of the dynamic response of materials and structures to impulse primary blast impact involving everything from car and aircraft collisions to impacts of space structures by assorted debris The understanding of hydrocodes requires knowledge of numerical methods in the code as well as a keen

understanding of the physics of the problem being addressed This can take many years to learn via codes There are currently a number of titles addressing the physics of high pressure and high rate material but nothing introducing the novice to the fundamentals of this highly technical and complicated study Introduction to Hydrocodes bridges the gap bringing together the large body of literature scattered through diverse journals government and corporate reports and conference proceedings As valuable as the text are the cited references and the combination will take years off the preparation time of future code users Introduces complex physics essential for the understanding of hydrocodes Infused with over 30 years practical experience in the field Brings together a wide range of literature saving valuable research time *Monthly Catalog of United States Government Publications* United States. Superintendent of Documents, 1977 February issue includes Appendix entitled Directory of United States Government periodicals and subscription publications September issue includes List of depository libraries June and December issues include semiannual index Guide to Stability Design Criteria for Metal Structures Theodore V. Galambos, 1998-06-15 This book provides simplified and refined procedures applicable to design and to accessing design limitations and offers guidance to design specifications codes and standards currently applied to the stability of metal structures **Journal of Applied Mechanics**, 1977 Publishes original research in all branches of mechanics including aerodynamics aeroelasticity boundary layers computational mechanics constitutive modeling of materials dynamics elasticity flow and fracture heat transfer hydraulics impact internal flow mechanical properties of materials micromechanics plasticity stress analysis structures thermodynamics turbulence vibration and wave propagation **Bulletin** Welding Research Council (U.S.), 1985 **A Mathematical Model for the Prediction of Impact Force Due to Ship Collision** Pin Yu Chang, C. Thasanatorn, 1980 *Monthly Catalogue, United States Public Documents*, 1977 *Naval Research Reviews*, 1977 **Science Trends**, 1975-03 **Monthly Catalog of United States Government Publications**, 1977 Government Reports Announcements, 1974 Lightweight Ballistic Composites Ashok Bhatnagar, 2006-06-30 Ballistic composites need to be lightweight and durable as well as exhibiting high impact resistance and damage tolerance This important book reviews these requirements how the materials used for ballistic composites meet them and their range of applications After an introductory chapter Lightweight ballistic composites is split into two main sections The first part of the book explores material requirements and testing There are chapters on bullets and bullet fragments material responses to ballistic impact standards and specifications modelling and test methods Part Two reviews the range of materials used production methods and applications Topics discussed include high performance ballistic fibres and ceramics non woven ballistic and prepreg composites and their uses in body armour vehicle and aircraft protection This major book is the first of its kind to give a comprehensive review of the current use of lightweight ballistic composites in both military and law enforcement applications It is an invaluable reference for all those involved in personnel and vehicle protection in defence and police forces around the world Reviews the current use of lightweight ballistic composites in both

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