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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.

The Finite Element Method (FEM) has become an indispensable technology for the modelling and simulation of engineering systems. Written for engineers and students alike, the aim of the book is to provide the necessary theories and techniques of the FEM for readers to be able to use a commercial FEM package to solve primarily linear problems in mechanical and civil engineering with the main focus on structural mechanics and heat transfer. Fundamental theories are introduced in a straightforward way, and state-of-the-art techniques for designing and analyzing engineering systems, including microstructural systems are explained in detail. Case studies are used to demonstrate these theories, methods, techniques and practical applications, and numerous diagrams and tables are used throughout. The case studies and examples use the commercial software package ABAQUS, but the techniques explained are equally applicable for readers using other applications including NASTRAN, ANSYS, MARC, etc. A practical and accessible guide to this complex, yet important subject Covers modeling techniques that predict how components will operate and tolerate loads, stresses and strains in reality

Railway track are used as way for carrying cargo or passengers from one place to another place. Nowadays, Malaysia still using the old railway line and accidents can happen at any time due to several factors, namely high density load of railroad rails, cracks due to vibration and friction wheel. Therefore, in this project the analysis is to prevent and predict the occurrence of harm or injury to passengers, and goods. The objective of this project is to determine the value of fracture toughness of railway track material using analytical solution. Finite element analysis is used to find the value of stress that has been used in analytical equation. The design of the model specimen drawn by Solidworks software and then imported into the Patran software to key in data such as load, material, element, and properties. Then, Nastran software is used as a solver and decision analysis model will be produced when the specimen is successful simulated. Comparisons are made between the simulation using finite element analysis and previous research. The result shows that the fracture toughness decreasing when the thickness is increasing. The average value of fracture toughness found was 39.02 MPa.?m. It is said to be plane strain fracture toughness.

This dissertation, "Finite Element Analysis of Vibration Excited by Rail-wheel Interaction" by Yun, Zhan, ??, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: In previous attempts reported in the open literature on modelling rail/wheel dynamics, beam theories are commonly employed to model the rail and rail-wheel contact can be considered by linear or nonlinear contact springs. As the contact force is expected to have a strong influence on the rail corrugation, the predicted contact force is often the key interest. It is noted to be a rather smooth function of time and is different from, for instance, the rail acceleration which contains a considerable amount of high frequency content. On the other hand, finite element method has evolved into a widely accepted numerical simulation tool for engineering analysis. Despite its applicability to many physical phenomena, three-dimensional finite element simulation of rail-wheel dynamic interaction remains to be a computationally formidable task due to the minute size of the rail-wheel instantaneous contact zone. In this thesis, a beam and a plane finite element models are constructed to examine the rail-wheel dynamic interaction. The beam finite element model composes of two-dimensional Timoshenko beam elements whilst contact is mimicked by using a nonlinear contact spring. On the other hand, the plane finite element model composes of plane elements. While very small elements are used on the contacting surfaces, i.e. the wheel rim and rail top, the element size away from the surfaces is kept large in order to reduce the number of elements. To transit the mesh from dense to coarse, different transition meshes are examined and the one showing the best accuracy is employed. Meanwhile, two different ways of simulated contact are examined. The chosen method of kinematic constraint can deliver a reasonable accuracy and, unlike the penalty method, would not reduce the critical time increment in explicit time integration. The contact forces predicted by the beam and plane finite element models are compared. It is noted that the trends of the contact forces predicted by two finite element models show good agreements with each other. However, the plane finite element model has several advantages in the simulations of rail/wheel dynamics over the beam finite element model. The effects of high wheel speed and multiple rolling wheels on rail/wheel dynamics are investigated. It is found that both the high wheel speed and multiple rolling wheels on a rail lead to more severe rail vibrations. Owing to its advantages in the simulations of rail/wheel dynamics, the plane finite element model is then applied to examine the damping capacities of tuned mass damper which is a promising means for reducing the rail vibration. The predicted rail acceleration reveals that the rail vibration can be attenuated considerably when the tuned mass damper is installed. DOI: 10.5353/th_b5351000 Subjects: Railroad cars - Dynamics - Mathematics

Ballast plays a vital role in transmitting and distributing train wheel loads to the underlying sub-ballast and subgrade. Bearing capacity of track, train speed, riding quality and passenger comfort all depend on the stability of ballast through mechanical interlocking of particles. Ballast attrition and breakage occur progressively under heavy cyc

Catastrophic bearing failure is a major concern for the railroad industry because it can lead to costly train stoppages. Excessive heat buildup within the bearing is one of the main factors that can warn of impending failure. The work presented in this book is motivated by the need to understand the heat transfer paths to the bearing when wheel heating occurs. A series of experiments and finite element analyses were conducted in order to quantify the different heat transfer mechanisms, with an emphasis on radiation.

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