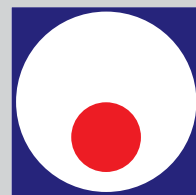




FACULTY OF MECHANICAL AND CIVIL ENGINEERING
IN KRALJEVO
UNIVERSITY OF KRAGUJEVAC



The Eighth Triennial
International Conference

HEAVY MACHINERY HM 2014

Proceedings

ZLATIBOR, SERBIA
24 - 26 June 2014



**FACULTY OF MECHANICAL AND CIVIL ENGINEERING KRALJEVO
UNIVERSITY OF KRAGUJEVAC
KRALJEVO – SERBIA**

THE EIGHTH INTERNATIONAL TRIENNIAL CONFERENCE

HEAVY MACHINERY HM 2014

PROCEEDINGS

Zlatibor, June 25 – June 28 2014.



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UNIVERSITY OF KRAGUJEVAC
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ORGANIZATION SUPPORTED BY:

Ministry of Education and Science, Republic of Serbia

Zlatibor, June 25 – June 28 2014



PUBLISHER:

Faculty of Mechanical and Civil Engineering, Kraljevo

EDITORS:

Prof. dr Milomir Gašić, mech. eng.

PRINTOUT:

SaTCIP d.o.o. Vrnjacka Banja

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No. of copies: 200

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PREFACE

The Faculty of Mechanical Engineering Kraljevo has been traditionally organizing the international scientific conference devoted to heavy machinery every three years. The VIII International Scientific Conference HM 2014 is considering modern methods and new technologies in the fields of transport design in machinery, control energy, production technologies, urban engineering and civil engineering through thematic sessions for the purpose of sustainable competitiveness of economic systems. Modern technologies are exposed to fast changes at the global world level so that their timely application both in large industrial systems and in medium and small enterprises is of considerable importance for the entire development and technological progress of economy as a whole.

The VIII International Scientific Conference Heavy Machinery HM 2014 is a place for exchange of experiences and results accomplished in domestic and foreign science and practice, with the goal to indicate directions of further development of our industry on its way toward integration in European and world economic trends. Exchange of experiences between our and foreign scientific workers should contribute to extension of international scientific-technical collaboration, initiation of new international scientific-research projects and broader international collaboration among universities.

The papers which will be presented at this Conference have been classified into seven thematic fields:

- A. EARTH-MOVING AND TRANSPORTATION MACHINERY
- B. PRODUCTION TECHNOLOGIES
- C. CIVIL ENGINEERING AND MATERIALS
- D. AUTOMATIC CONTROL, ROBOTICS AND FLUID TECHNIQUE
- E. MACHINE DESIGN AND MECHANICS
- F. RAILWAY ENGINEERING
- G. URBAN ENGINEERING, THERMAL TECHNIQUE AND ENVIRONMENT PROTECTION

Within this Conference, the First International Students Symposium will be held. The aim is to open a scientific discussion on this actual problem in industry among young students.

The sponsorship by the Ministry of Science of the Republic of Serbia is the proper way to promote science and technology in the area of mechanical engineering in Serbia.

On behalf of the organizer, I would like to express our thanks to all organizations and institutions that have supported this Conference. I would also like to extend our thanks to all authors and participants from abroad and from our country for their contribution to the Conference. And last but not the least, dear guests and participants in the Conference, I wish you a good time in Kraljevo – Vrnjačka Banja and see you again at the Eight Conference, in three years.

Kraljevo – Zlatibor, June 2014

Conference Chairman,


Prof. Dr. Milomir Gašić, mech eng.

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CAD Model of Disc Brake for Eliminating Noise Problems

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Highway safety and stopping power are always at the forefront of discussions within the commercial vehicle industry. Air disc brake (ADB) systems have been available for commercial vehicles since the 1970s. The technology initially suffered teething problems, but brake manufacturers say today's air disc brakes are highly dependable and reliable with superior stopping characteristics that make them an obvious candidate for fleets wanting to make certain they are in compliance with the new stricter regulations. One of vehicle components that occasionally generate unwanted vibration and unpleasant noise is the brake system. As a result, carmakers, brake and friction material suppliers face challenging tasks to reduce high warranty payouts.

This study takes into consideration three major aspects of modelling of a real disc brake so that the model can be built in a more realistic way. There are the structural model, the friction model and the contact model. A fully numerical method is used where all the disc brake components are modelled and analysed using finite element software packages. Having developed the disc brake components, modal analysis is carried out at the brake components and assembly levels. Friction and contact model are included when all the brake components are brought together.

Keywords: CAD, disc brakes, FEM, modeling, noise

1. INTRODUCTION

Highway safety and stopping power are always at the forefront of discussions within the commercial vehicle industry. Air disc brake (ADB) systems have been available for commercial vehicles since the 1970s. The technology initially suffered teething problems, but brake manufacturers say today's air disc brakes are highly dependable and reliable with superior stopping characteristics that make them an obvious candidate for fleets wanting to make certain they are in compliance with the new stricter regulations.

ADB's are now accepted as the primary foundation brake in Europe. Drum brakes are still used on off-road vehicles (mining, construction, military, etc.) and on vehicles for export to other continents - 18 percent of total European Union (EU) brake demand.

Among the reasons for introduction of ADBs in EU are:

- With ADBs, brake fade is virtually eliminated, proven from Alpine testing.

- Inherent high-efficiency (greater than 95 percent) and low hysteresis ensure a negligible pull (different brake performance left and right) to deliver controlled vehicle steering and braking stability

- This same high-efficiency and stability enable the highest-quality of control functions for electronic control systems like ABS, electronic braking systems (EBS) and electronic stability systems. (ADB's were introduced in parallel with EBS in the EU during 1996)

- ADBs support intelligent functions, such as continuous wear sensors, brake pad wear monitor and, in the future, electronic clearance control

- New ADBs designs reduced stopping distance up to 30 percent at the time of introduction in the EU, compared with then-current drum brakes

- ADBs enable simpler, quicker pad change vs. drum shoes and have an integrated automatic wear adjuster function.

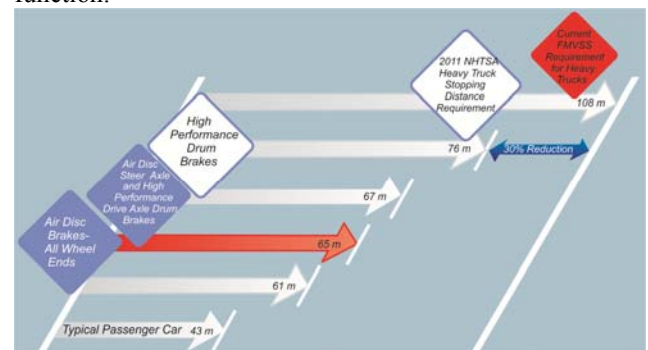


Figure 1: Comparison of FMVSS Stopping Distance Requirements from 60 MPH

More than 90 percent of trucks in the United States still spec s-cam drum brakes. However, ADBs are widely used on refuse trucks and transit vehicles. There are several reasons contributing to the slow adoption of ADBs in North America (NA). Firstly, in Europe, the truck OEMs decide the vehicle specs, whereas NA is predominately a customer spec market. Next, there is a different service infrastructure. Trucks are serviced at OEM dealers in Europe by factory-trained and equipped technicians, so technology changes can be more easily managed and facilitated. In NA, vehicles are serviced at a wide variety of service locations, so conversion to new parts and training is more complex. Another factor is that trucks in North America are dynamically different so the impact of ADBs is less. Plus, the upfront costs for ADBs are more than drum brakes. Further, in general, technology application lags in North America compared to Europe.

Some of the brakes trends in the North American market are:

