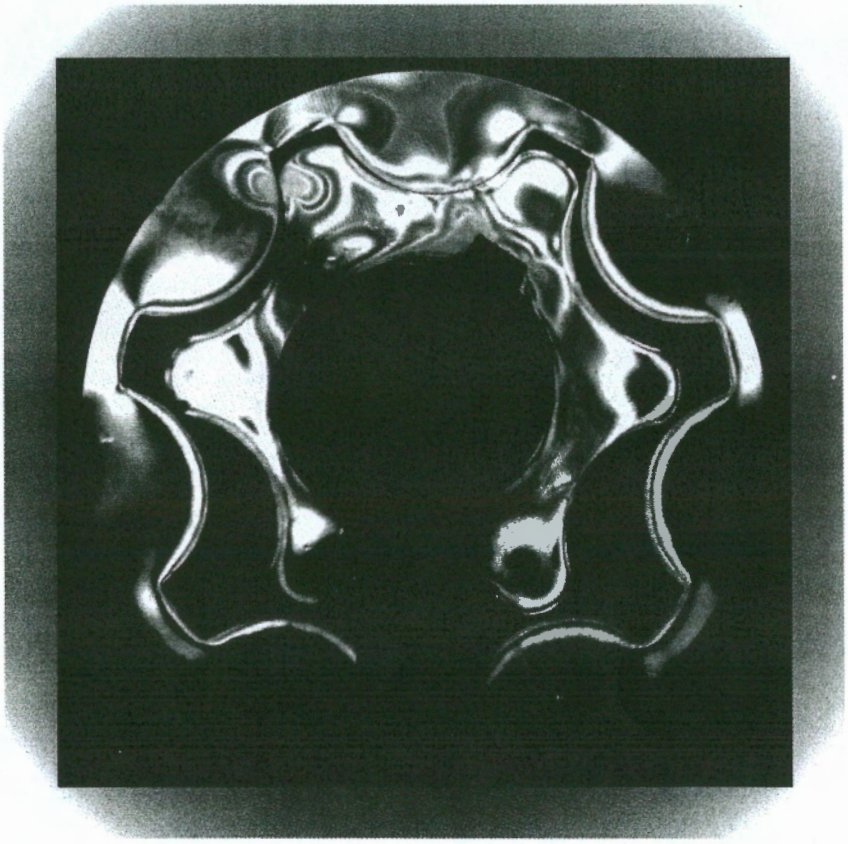
DANUBIA

DRIA

27th Symposium
on Advances in Experimental Mechanics



Wrocław University of Technology

100 YEARS OF TECHNICAL UNIVERSITIES IN WROCŁAW 1910-2010

Committee of Mechanics of Polish Academy of Sciences

SIMP

22nd-25th September 2010
Wrocław, Poland

Wrocław the meeting place

DANUBIA

ADRIA

27th Danubia-Adria Symposium on Advances in Experimental Mechanics

September 22nd-25th, 2010

Wrocław University of Technology

Wrocław / Poland

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Polish Society of Mechanical Engineers and Technicians

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Preface

Scientific conferences of Experimental Mechanics in Europe have already a 26-year long tradition. The first Danubia Adria Symposium took place in 1984 in Stubicke Toplice - Croatia. The current Symposium DAS2010 is the second conference organized in Poland. After the 19th DANUBIA-ADRIA symposium on Experimental Methods in Solid Mechanics organized in Polanica Zdrój by the Mechanics Committee Polish Academy of Science, Warsaw University of Technology in 2002, Poland has the privilege of organizing again a scientific meeting of this prestigious international forum – the 27th DA Symposium on Advances in Experimental Methods Organized by Wroclaw University of Technology Faculty of Mechanical Engineering, in cooperation with Committee of Mechanics of Polish Academy of Science and ***Polish Society of Mechanical Engineers and Technicians.***

27st Danubia-Adria Symposium on Experimental Methods in Solid Mechanics (DAS 2010) represents a continuation to the series of fruitful meetings at the previous Danubia-Adria Symposia. The purpose is to provide a forum for engineers, researchers, university teachers and students, scientists and industrial experts to present and discuss the current status and impact of modern technology and development in the field of experimental methods in mechanics. The topics of the DAS 2010 are particularly concerned with recent research and development of experimental and numerical methods for quality enhancing structures, service life and technical safety.

The 27th Danubia-Adria Symposium has an important significance, honored by its works the 100th Anniversary of Technical Universities in Wrocław .
Today's Wrocław University of Technology is an inheritor of the tangible property of the German Königliche Technische Hochschule Breslau and the intellectual and research traditions of the Lvov Polytechnic. In 2002 we have celebrated 300th anniversary of University of Wroclaw. 2010 is the year to celebrate a special milestone -100th anniversary of Technical Universities in Wroclaw. Today it educates over 30 thousands of them at 12 faculties.

This year's DAS symposium has received 124 accepted submissions from 14 countries. The Program Committee selected 14 papers for oral presentation and 109 papers for the commented poster presentation.

The 27th Danubia-Adria Symposium is the result of an effort of many other people from scientific centers in Poland and Europe. We would like to thank them all.
I believe that the present Symposium, with its aim to exchange ideas concerning the search for new models, construction solutions, and manufacturing technologies, will constitutive the next, very important step in the development of experimental mechanics.

On behalf of the Organizing Committee of the 27th DANUBIA-ADRIA Symposium on Advances in Experimental Methods, organizers wish a warm WELCOME to all the participants in Wrocław - and hope that all the guests will have a pleasant time in Poland.

Chairman of 27th DAS Symposium on Advances in Experimental Mechanics

Romuald BĘDZIŃSKI

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1. Introduction

The different buffing tests shall not result in any visible permanent deformations. The stresses occurring at certain critical points of the bogie/underframe, underframe/body and superstructure connections shall be recorded.

An unbraked wagon standing on level straight track shall be capable, both when empty and laden, of withstanding the buffing shock resulting from impact by a wagon with a total laden weight on rail of 80 t and fitted with side buffers with a buffer energy storage capacity. In accordance with this fact, defined by TSI standard [1] - annex Z, for the numerical finite element method analysis, it is necessary to develop a special finite element for modelling buffer for impact (buffing) test. The results of numerical analysis of buffing impact test of wagon type Schimms, for transportation of metal sheet coils, are presented in this paper. We have two type of analysis: first without and second with using special developed contact element for buffing impact test.

2. FEM model

Wagon is intended for transportation of metal sheet coils, type Schimms, loaded on wagon with horizontal axis. Wagon was modeled using FEMAP software [2]. According to the construction type shell elements with specified thickness and 3D elements (using for modeling of suport plate, compresating ring and traction stop) are used for creating the finite element mesh.

Structure is modeled in details with 94576 elements and 94142 nodes. Figure 1 shows finite element mesh of half wagon without bogies, which was used for numerical simulation of buffing impact test, taking in consideration correspondent symmetry. Colors on Figure 1 match the various thicknesses of shell elements.

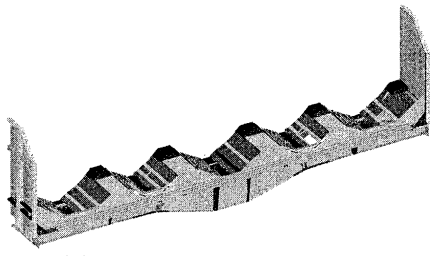

Fig. 1: Finite element mesh – half wagon model; outer view

3. Numerical analysis – Buffing test

In accordance with TSI standard - annex Z, it is simulated buffing impact test with buffing speed of 12km/h. The result of analysis, Von Mises equivalent stress field, in the last step of analysis is shown in Figure 2, [3]. Maximal value of equivalent stress is 235MPa.

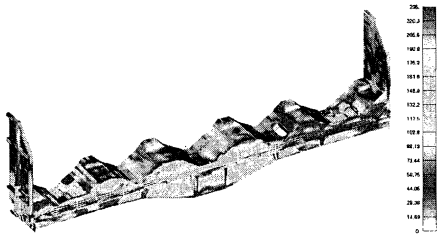

Fig. 2: Results of numerical analysis of the buffing impact test; Von Mises equivalent stress field

Buffing impact tests with empty wagons are carried out to investigate the effects of inertia, the connection between bogie and underframe and reaction of superstructure. Buffing impact tests are conducted at speeds that increase of 8 km/h to 12km/h.

The second part numerical analysis was made using specially developed finite element for modelling buffer for impact (buffing) test. Rods, modeled with inelastic material model of

springs, are added to the model shown in Figure 1 and simulate the buffer [4].

This type of finite element provides the type of inelastic tension (pressure) regardless of whether the axial or torsion spring. As an option, it is possible to further specify different values of stiffness, when load and unload spring. Assign stiffness of unload give us to acquire diagram Force-Displacement shown on Figure 3.

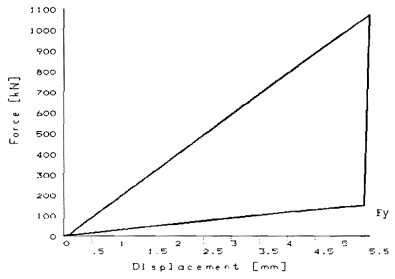

Fig. 3: Diagram Force-Displacement for one pair of rings

Stiffness of unload is several order size bigger than standard stiffness and provide that the wagon in the unload state do not rebuff, what it happens in cases of standard stiffness (high elasticity). Due to the definition of this parameter we have almost vertical curve of unload.

The result of numerical analysis, Von Mises equivalent stress field, using of special developed contact finite element for buffing impact test is shown on Figure 4. Maximal value of equivalent stress is 154MPa.

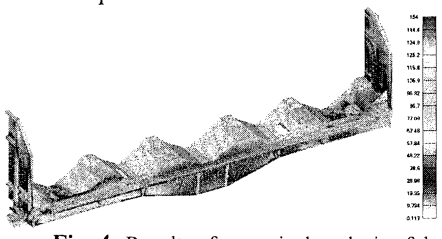

Fig. 4: Results of numerical analysis of the buffing impact test using special developed contact finite element; Von Mises equivalent stress field

In accordance with TSI standard - annnex Z, buffing impact tests shall not result in any visible permanent deformations. The stresses occurring at certain critical points of the bogie, underframe and superstructure, do not exceed permissible stresses which are defined standards for the calculation of wagon's constructions

4. Conclusions

This aim of this paper was that developed contact finite element for buffing impact has practical application. Numerical simulation of buffing impact test of empty wagon type Schimms, without and with using special developed contact element for buffing impact test, in accordance with TSI standard, the results were analyzed [3]. Analysis showed that the developed contact finite element can be used in numerical simulations for record stresses that occur in buffing impact tests, which is a requirement that wagon's constructions must meet in the process of serial production, in accordance with the standards

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References

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