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DISSERTATION REVIEW

OF THE DOCTORAL THESIS

Doctoral thesis:	**ACCURACY IMPROVEMENT OF MEASUREMENTS BY ANALYZING DYNAMIC RESPONSE OF A TRAM WHEEL ROLLER - RIG**
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Branch of study:	3706V005 Transport Means and Infrastructure
Program of study:	P3710 Technique and Technology in Transport and Communications
Schooling place:	University of Pardubice Jan Perner Transport Faculty Department of Transport Means and Infrastructure

1. UP-to dateness of the topic

Investigations by means of true scale test stands is very attractive way of technical systems properties detecting. It is not cheap, easy or simple way, but it may be very effective. This manner is based on the adequacy of model laboratory solution to the real operational condition of the examined phenomena. The great advantage of the test stands utilisation is the fact, that in laboratory conditions can be analysed technical systems responses due to the technical systems excitation.

The results analyse is crucial dependent on the accuracy of measurements performed on the laboratory test stands. The special category of the test stands introduce the roller rigs. They are widely used for different railway phenomena investigation. Never mind the purpose is, the crucial feature of each of stands is the reliability and trustworthiness of gained data. The experiments and analysis were performed on the full-scale tram roller rig in the laboratory of the PhD. schooling place.

2. Selected methods of writing

Selected method of writing is standardly used for the dissertation work completing. The work consists of ten chapters with introduction as the first chapter and references as the 10-th final chapter. The work is completed by list of figures, tables, abbreviations and symbols. The dissertation thesis has 114 numbered pages. The structure of the thesis is common, where in the beginning of the work is analysed the situation in the area of dissertation. There is a literature review in the chapter Nr. 2. There are described some known test stands. This chapter in the next

deals with some known wheel – rail interaction analysis methods. The specification of dissertation objectives is in chapter Nr. 3: Definition of dissertation objectives. The scheme of sub systems of roller rig and investigation methods is here. I appreciate, that this definition is in a special part – chapter. In the chapter Nr. 4 is explained the methodology and shown the results. The mechanical, electrical design and data acquisition system of the test stand are described. There are determined the source and causes of possible inaccuracies. The results of the stationary parts, from the numerical computations and experimental analysis and other analysis and computations are here. This part is of the highest importance and it is of the largest range.

The chapter Nr. 5 contents the discussion. There are discussed the hypothesis and presuppositions as well as the conclusions, that state whether these were proved or not.

The chapter Nr. 6 contents the conclusion. The PhD. Students summarised the conclusion where as a result of the whole study, three conceptual solutions are proposed, and proposed solutions have been simulated in order to provide an improvement in the measurement quality of the roller-rig.

In the chapter 7 are mentioned the recommendation for the next improvements of the investigations on the test stands.

The proposed thesis structure is meaningful and proportions of the text formations is acceptable. The Ph.D. student uses correct technical terms specified for the processed field of study. The work is written on a good graphical level. There is listed a lot of references of literature in the conclusion of presented work: 124 items. This list follows the list of publication of the PhD. Student.

3. Objectives and their meeting

Objectives of the work are written in the separate chapter No. 3: “Definition of dissertation objectives”. The overall objective of the dissertation was to improve the quality of the measured data by analysing the dynamic behaviour of a full-scale tram wheel roller rig from the mechanical aspect. In order to achieve this objective, several sub-objectives had to be accomplished. Six sub objectives were listed. These parts, as the student wrote, had to be analysed and investigated with proper tools such as experimental procedures, structural analyses, etc. All those components described under main system were to be analysed step by step. Possible weakness in these individual components were intended to be revealed. Identification of issues, details of abovementioned roller rig, used methodologies, experimental instruments and initial results was presented in the work sections.

In the other text is widely in detail described all the procedure or the chain of steps, that could lead to the requested aim. More precisely, there are in advance specified every detailed activities, that are needed to meet the specified work.

On the base of the thesis study I can express, that **thesis objectives were fulfilled**.

4. The dissertation thesis adding

- A literature summary of the types, sizes, and purposes of the roller rigs have been provided. Some information of them may not be completely up to date today, but the survey can be taken as a relevant to the studied topic.
- Specific issues related to adhesion measurement on a full-scale tram wheel roller rig have been identified. It may be useful for other investigations.
- A FEM model of the roller-rig frame has been generated and the model results were compared with experiments. It is a good message, that the robustness of the frame of the roller-rig against the loads was proven.
- A torsional mathematical model was derived. The behavior of the torsional system of the roller-rig analyzed by means of computer simulations was compared with experiments. This model probably can be used to simulate possible component changes in the system.
- The robustness of the mechanical system was verified.
- The good fact that torque signal was not affected by bending in the shaft was identified.

The systematic investigation in this theoretical and experimental field and by means of computer simulation computation comparable results, I can take into account as new findings.

5. Significance for profession or scientific development

The work may be adequately significant for the PhD. schooling place researchers involved into the roller rig utilisation. In this work specific issues related to adhesion measurement on a full-scale tram wheel roller rig have been identified. A finite element model of the roller-rig frame was created and the results of the computer simulation were compared with the results of measurements from experiments. The behaviour model of the torsional system of the roller-rig was derived and the results of computations were compared with the experiments results. The results show, that the torque signal is not affected by bending in the shaft and the smoothing filter was designed and optimised by the author of the dissertation thesis.

6. The extend and quality of the published works related to the dissertation

In dependence on the processing of this work, during the doctoral study were processed and published 6 publications. Three of them were published on the conferences in Czech Republic, one in Turkey. Advantage of conference articles is, that probably all of them were presented in front of experts in field of study. One article was published and one is in press in scientific journals. Two articles were registered in Web of Science and one from the journal “IEEE Transactions On Vehicular Technology” is registered in the SCOPUS database. So this one express, that the acceptable quality of the published works has been achieved.

The Doctoral thesis and Doctoral thesis precis fulfilled all requirements there are connected with this type of document.

FINAL ASSESSMENT

I can state, that reviewed dissertation thesis of **Ing. Bekir Tuna KAYAALP** meets the requirements for creative scientific work for awarding the title

„Philosophiae doctor"
(Ph.D.)

Žilina, 10.01. 2020 prof. Dr. Ing. Juraj GERLICI