

Expert opinion on the dissertation thesis

Candidate: **Utku KAYA**

Title of dissertation: Degradation Processes of Materials Due To Contact - Fatigue Loading

Educational institute: University of Pardubice, Jan Perner Transport Faculty

Supervisor: prof. Ing. Eva Schmidová, Ph.D.
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Reviewer: Ing. Zdeněk Malkovský, Ph.D.
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Up-to-dateness of the topic

Modern railway transport is characterized by constantly increasing driving speed especially in railway passenger carriage and by increasing axle loads for freight rolling stock. Such increasing parameters obviously evolve pressure to increase useful properties and parameters of the infrastructure and therefore rails and railroad switches. The chosen dissertation thesis topic is therefore highly topical not only from the perspective of the Czech Republic, but also in the international context.

Selected methods of writing

The overall editing of the dissertation thesis is good. The chapters logically follow. The total range of more than 80 pages including formal parts is sufficient. Certain minor deficiency are some formal imperfections. E.g. Fig. 17 is missing an explanation of the meaning of the curves. On page 60 only two of the three equations are numbered. On page 8 it says „As a consequence, the crack tip of a head check or squat experiences a moderate initial mode I cycle followed by a mode II shear cycle, at the end of the cycle, additional mode III loading can occur.“ Could the candidate at the defense further describe what is of the individual modes I to III characteristic?

Whether the work fulfilled the objectives

The targets of the dissertation thesis are clearly specified in Chapter 4. The aim of the dissertation thesis is to explore the possibility of evaluation of the actual state of the surface layers of steels used in the manufacture of rails and railroad switches for various mechanisms and stages of their degradation. Evaluation of the actual mechanical parameters of the surface layer, which is critical for the operating behavior of all types of used steels is therefore very important.

In the conclusion of the dissertation thesis the candidate summarizes how the dissertation thesis targets were met. Based on the results showed in the dissertation thesis it can be stated that the targets were unequivocally met.

The results of the dissertation thesis adding whether and what new findings it has brought

A concrete result of the dissertation is a process for determining changes in the mechanical properties of the surface layers of steel used in the construction of railroad switches. It concerns the changes in the surface layers induced by the contact fatigue loads. Researched evaluation methods can be used as reference methods for determining the residual plasticity. The proposed evaluation method can also be used to validate the experimental simulation for the process of fatigue loading, and the process for hardening by the blast.

Contribution to the solution was also the use of special rotational state from the Faculty of Transportation of Jan Perner. The actual experiment is described in the thesis rather succinctly. It would be appropriate for the candidate to closer describe the actual test at the defense of the dissertation thesis – bringing forces, time loading procedure, coefficient of friction etc.

Significance for profession or scientific development

The gained knowledge are usable not only for further research, but also in practice. The issue of determining the extent of mechanical changes in the surface layers of steel used was solved, which is induced by the contact fatigue loads and the proposed method facilitates monitoring of the elastic-plastic response of the surface. Proposed evaluation methods can be used as reference methods for determining the residual plasticity.

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

In the dissertation thesis there are given five posts, which the candidate worked out or on whose processing he participated. Posts related to the issues addressed in the dissertation thesis are mainly part of collections from conferences. One post was published on Scientific.net. Acceptance of the posts means that their quality was at the necessary level. However quotations should be accurate. The first post was, for example, published in 2014 and not in 2015 and had six pages, not just one.

Whether the dissertation thesis meets the requirements for creative scientific work for awarding the title Ph.D.

The presented dissertation thesis demonstrates the ability of the candidate of independent scientific work. I recommend granting a Ph.D.

Prague

15.08.2016


Ing. Zdeněk Malkovský, Ph.D.