

## **Review of Dissertation**

### **„Estimation of States and Parameters from Dynamic Response of Wheelset“**

**by Altan Onat, M.Sc.**

The submitted dissertation has extent 155 pages. It consists of the List of Abbreviations and Symbols, 6 chapters, 2 appendices, bibliography and the list of author's publications.

The first chapter is devoted to analysis of solving the problems of wheel-rail contact and dynamics of wheelsets and rail vehicles. The text is characterized by very extensive and competent references to literary sources. It shows very good orientation and deep theoretical knowledge in the field of dissertation.

At the second chapter Mr. Onat quotes the objectives of the dissertation thesis that are well and logically formulated.

The third, relatively extensive, chapter is devoted to overview of used methods and models. There are quoted models and solutions of wheel-rail contact problem here. The brief description of track irregularities is mentioned here as well. The next part is devoted to kinematic and dynamic model of wheelset and rail vehicle. Mr. Onat depicts filtering and especially Kalman filters at the end of this chapter.

The key part of dissertation thesis is in the fourth chapter where the results of solving of the dissertation topic are published. The results of several methods of searching a contact locus and size of contact patch are compared. Results of normal and tangential problem solution and a validation of dynamic models are given in the next part of the dissertation. The author should depict more clearly what software was used and to give the reasons of using the MBS software Universal Mechanism. The last part of this chapter contains results for parameter estimation and filtering scheme. The model is validated by means of comparison with measurements on roller-rig test stand as well. The Kalman filters are used for estimation of states and parameters of railway dynamic vehicle system from dynamic response.

Mr. Onat lucidly summarizes the results and contributions of the dissertation in the fifth chapter.

The sixth chapter contains the conclusion, where the methods and solutions of dissertation are summarized in brief.

The dissertation is formally written very well. There are only a few formal imperfections. Several examples of imperfections: the unequal symbols used in equation (3.1.) and in the line below, incorrectly labelled axe "y" (should be "z") at upper part of Fig. 3.8, the incorrect dimension of parameters  $a_1$  and  $a_2$  in the Table 3.5 (it should be "m"), the incorrect text in the Fig. 4.27 d (it should be  $\mu_0 = 0.5$ , not 0.2), etc.

### **The up-to-dateness of the topic of dissertation.**

The topic of dissertation thesis is actual. The problem is solved by new interesting techniques. The student's work is a contribution to development of algorithms for Kalman filtering in this area.

### **The selected methods of elaborating of dissertation.**

The selected methods of elaborating the dissertation are up-to-date. The methods are clearly described. The results of Mr. Onat are verified by comparison with very extensive references, by using several methods of solving and by comparison with measurements on roller-rig test stand.

### **The fulfilling of objectives of dissertation.**

The main objective of dissertation (i.e. testing of model based on filtering methods for parameters estimation) was fulfilled. Sub-objectives of this dissertation were fulfilled as well. The results of parameters estimation are showed and verified.

### **The results of dissertation thesis.**

The methods and models proposed in the dissertation were validated by several manners. The validation shows that all results were in good conformity. It was shown that utilization of Kalman and unscented Kalman filters is efficient for estimation of various parameters of rail vehicles dynamic systems.

### **The significance for profession or scientific development.**

The significance of presented dissertation for scientific development consists in application of new methods for estimation of states and parameters of rail vehicles and its parts, particularly its running gear. The significant contribution is application of Kalman and unscented Kalman filters in this field.

### **The extent and quality of the published works related to the dissertation.**

The extent of the published works related to the dissertation is satisfactory. The quality of published works is very good. They were published at the international scientific conferencies and in the international scientific journals. One of them is under preparation.

### **Meeting the requirements for creative scientific work for awarding the title Ph.D.**

The requirements for creative scientific work for awarding the title Ph.D. are satisfied. I recommend to accept the submitted dissertation for defence and after successful defence to award the title Ph.D. to Mr. Altan Onat M.Sc.

Žilina, February 27, 2017

