DOI: 10.13111/2066-8201.2013.5.3.15

Theory of Elastic Systems for Railway Vehicles

Ioan SEBEŞAN, Ion COPACI

Published by MATRIX ROM, 2008 (in romanian)
ISBN: 978-973-755-372-0

The Treaty "Theory of elastic systems in rail vehicles" address the main scientific and design issues in the conception, optimization and practical application area of the elastic systems as part of the construction of railway vehicles. Thus, based on the conditions to be fulfilled by an elastic system of a vehicle which are provided by the principles of railway vehicle dynamics theory, the authors present the suspension systems, the systems ensuring the taking over of shocks and vibrations along the vehicle, the elastic systems that perform the interaction with the contact line, the elastic systems of the machines axles drive, the elastic system that ensures the guidance and the axles orientation.

Given that the main perturbations which are exerted on the vehicle are caused by the rolling track, the authors approach at a high scientific level the main aspects related to the vehicle-rolling track interaction (Chapter 2).

The theory of the elastic systems is closely related to studies referring to the vehicle oscillations, putting into evidence both the possibilities of isolating the oscillations to achieve the running quality and the conditions imposed to ensure the safety of the guidance and running with minimal wear of both wheels and rails (Chapter 3).

The paper also analyzes a series of aspects related to the specific problems of tribology of wheel-rail contact, useful in the studies referring to the orientation of the wheelset, the hunting motion of the vehicle and also the stick-slip phenomenon occuring in motor vehicles (Chapter 4). We can remark the original study developed by Prof. Ph.D. Eng. Ioan SEBEŞAN. Thus, this treaty presents the original study of Prof. Ph.D. Eng. Ioan SEBEŞAN on theoretical considerations underlying the determination of elastic constants and damping of suspension systems (§ 3.3), the influence of the suspension on the axle load (§ 4.7), the influence of the pantograph elastic elements to ensure press forces on the contact line (§ 4.8), the shock of attack (§ 5.4). Also, original researches refers to the issues of the longitudinal shock systems developed by Prof. Ph.D. Eng. Ioan COPACI.

A particular attention was given to theoretical problems (mechanical and mathematical models) of the conventional and high speed vehicles. Thus, after chapter 1 examines the problems of speed limits in the wheel-rail system and contact phenomena at high speeds, chapter 2 shows the influence of the suspension on the critical hunting speed,which is a limiting factor of maximum high speed movement; chapter 4 presents the influence of the elasticities from the driving system of axles on the hunting stability of a bogie. Other aspects related to high-speed refer to the axle movement and dynamic overload exerted by the axle on rail, taking into account the randomness of distortion of the track, the influence of the

suspension on conventional and unconventional vehicles kinematics (with body tilt) at the movement in curve, elasticities influence from axle driving system on the geometric settlement in curves (Chapter 5) and dynamic effects at cylindrical coil springs (Chapter 6). In order to assess the behavior of the vehicle in circulation/service chapter 10 presents evaluation criteria of movement quality, regarding the oscillations of the vehicle. Thus was presented the theory of Sperling (§ 10.2) and the evaluation of the movement/running quality depending on the fatigue of travelers.

This paper presents common models of elastic systems with metal and rubber springs and also modern pneumatic systems. In addition to the most popular as a buffer elements, magneto-rheological dampers are presented under the aspects of their construction and calculation elements.

In conclusion, I would point out that this treaty address at a high scientific level, the whole issue of elastic systems of railway vehicles, putting into evidence the most advanced theories on this issue. It is very interesting the manner in which they managed to develop a logical specific theory of any rail vehicle and which can be extended to other types of vehicles such as cars and aircrafts.

The entire treaty intended to achieve the dynamic performance related to the safety of the vehicle guidance, the movement quality and their running conditions. Also, we can remark the fact that the treaty shows for the first time many applications of mechanical models specific to high speeds.

From the analysis of this paper I can conclude that the treaty "Theory of elastic systems in rail vehicles" brings a valuable contribution to the development of science.

Through the systematic presentation of the main aspects of modeling specific phenomena of railway vehicles dynamics, the authors contributes to the elucidation of problems highlighted by specialists in the field ever since the end of XIX century and also of the specific particularities to modern high-speed vehicles.

The studies performed by Prof. Ph.D. Eng. Ioan SEBEŞAN, of which a large part are addressed in this Treaty, contributes to both broadening the knowledge in the field and also the development of railway vehicles school, especially through doctorate/doctoral school in the field of transport engineering. Under Prof. Ph.D. Eng. Ioan SEBEŞAN many specialists had obtained their Ph.D. and have addressed in their theses aspects of the theory of elastic systems.

Prof. Ph.D. Eng. George STOICESCU
Technical University of Civil Engineering Bucharest
Faculty of Railroads, Roads and Bridges
Lacul Tei Bvd., no. 122 – 124, 020396, sector 2, Bucharest
gstoicescu@cfdp.utcb.ro