Freight Long Wagon Dynamic Analysis in S-Curve by Means of Computer Simulation

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The article deals with the dynamic analysis of long freight wagon with a low and multifunctional loading plane for intermodal transport. The main task of simulation was to verify enough overlap of buffers, when the vehicle rides through S-curve, because the wagon is equipped with non-standard construction of the front part of undercarriage. Simulation was performed in program Adams, module VI-Rail. These and similar analyzes are nowadays an integral part of the development process of rolling stock and greatly reduce the time necessary for design, tests and certification of new vehicles. In the future, it will be possible in the case of verification results replace some real tests by simulation analysis on certain conditions.

Keywords: S-curve, Long wagon, Buffers overlap, Dynamic analysis.

Acknowledgement

The work was supported by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences in project No. 1/0347/12: "Railway wheel tread profile wear research under the rail vehicle in operation conditions simulation on the test bench", project No. 1/0383/12: "The rail vehicle running properties research with the help of a computer simulation." and the project No. APVV-0842-11: "Equivalent railway operation load simulator on the roller rig".

Research-Educational Centre of Rail Vehicles (VVCKV)

References

[1] Adams 2011r1 and VI-Rail 2011r1, help.

[2] DIŽO, J. (2015). Evaluation of Ride Comfort for Passengers by Means of Computer Simulation. In: *Manufacturing Technology*. Journal for Science, Research and Production. Vol. 15, No. 1. ISSN 1213-2489.

[3] DIŽO, J., BLATNICKÝ, M., SKOČILASOVÁ, B. (2015). Computational modelling of the rail vehicle multibody system including flexible bodies. In: *Communications*: scientific letters of the University of Žilina. Vol. 17, Issue 3, 2015, Pp. 31-36. ISSN 1335-4205.

[4] DIŽO, J., BLATNICKÝ, M. (2015). Development of a flexible multibody system of a rail vehicle. In: *TRANSCOM 2015*: 11th European conference of young reserchers and scientists: Žilina, June 22-24, 2015, Slovak Republic. – Žilina: University of Žilina, 2015. – ISBN 978-80-554-1048-7. Pp. 58-63.

[5] EN 15839: *Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Freight wagons - Testing of running safety under longitudinal compressive forces.*

[6] GERLICI, J., ŠŤASTNIAK, P., LACK, T., HARUŠINEC, J. (2015). Design of long freight railway wagon with variable use of loading space. In*: Dynamical problems in rail vehicles 2015*: Polish - Slovak scientific workshop: Warsaw 2015. - Warsaw: Warsaw University of technology, 2015. - ISBN 978-83-7814-367-3. - pp. 6-13.

[7] GERLICI, J., JANÍČEK, F., LACK, T. (2004). Usage of computer aided technologies in a rail vehicles design. In: *Scientific bulletin of North University of Baia Mare*: Fascicle: Mechanics, Tribology. Machine Manufacturing Technology. ISSN 1224-3264. Series C, Vol. XVIII, pp. 113-118.

[8] KLIMENDA, F., RYCHLÍKOVÁ, L., PETRENKO, A., SVOBODA, M. (2015). Investigation of Vertical Vibration of a Vehicle Model Driving Through a Horizontal Curve. In: *Manufacturing Technology*. Journal for Science, Research and Production. Vol. 15, No. 2. ISSN 1213-2489.

[9] MAŇUROVÁ, M., SUCHÁNEK, A. (2015). Determination of secondary suspension stiffness of a rail vehicle bogie. In: *Dynamics of rigid and deformable bodies 2015* [electronic source]: the twelfth edition of the International Scientific Conference: Ústi nad Labem, Czech Republic, October 7-9, 2015. – Ústi nad Labem: Faculty of Production Technology and Management, University in Ústi nad Labem, 2015. ISBN 978-80-7414-914-6. – CD-ROM, [10] p.

[10] ONDROVÁ, Z., GERLICI, J., LACK, T. (2008). Dinamic simulation analysis of a railway vehicle running on a real track. In: *Dynamics of rigid and deformable bodies*, Ústi nad Labem, Czech Republic: University J. E. Purkyně. ISBN 978-80-7414-030-3. pp. 133-138.

[11] SKOČILASOVÁ B., SKOČILAS, J., SOUKUP, J. (2008). Experimental determination of natural frequencies and stiffness of suspension of flexible mounted body, application on road and railway vehicles (In Czech). *Acta Mechanica Slovaca*, No. 3-B/2008, CD ROM, vol. 12, pp. 715 - 726, Košice, 2008, ISSN 1335-2393.

[12] PELAGIĆ, Z., MOČILAN, M., SMETANKA, L., ŽMINDÁK, M. (2014). Finite element crack propagation analysis of test speciments. In: *Technológ*: magazine for the theory and practice of mechanical technologies. Vol. 6, No. 2, 2014, pp. 125-129. ISSN 1337-8996.

[13] ŠŤASTNIAK, P., HARUŠINEC, J. GERLICI, J., LACK, T. (2014). Structural design of long freight railway wagon with variable use of loading space. In: *Dynamics of rigid and deformable bodies 2014* [electronic source]: proceedings of twelve International Scientific Conference: Ústi nad Labem, Czech Republic, October 8-10, 2014. – Ústi nad Labem: Faculty of Production Technology and Management, University in Ústi nad Labem, 2015. ISBN 978-80-7414-949-4. – CD-ROM, [8] p.

Paper number: M2015171