
Algorithm for inverse determination of derailment coefficient by using instrumented wheelsets

Milan Bižić* and Dragan Petrović

Faculty of Mechanical and Civil Engineering in Kraljevo,

University of Kragujevac,

Dositejeva 19, 36000 Kraljevo, Serbia

Fax: +381-36-383-377,

Email: bizic.m@mfkv.kg.ac.rs

Email: petrovic.d@mfkv.kg.ac.rs

*Corresponding author

Abstract: The main indicator of the running safety of railway vehicles is the ratio between lateral and vertical forces in the wheel-rail interaction, known as derailment coefficient. Its exact determination has a huge significance in the development and certification phases of railway vehicles. The most reliable determination of wheel-rail interaction forces is based on experimental testing, by using instrumented wheelsets, which is otherwise prescribed in appropriate international regulations. This paper presents a unique algorithm for inverse determination of wheel-rail interaction forces, i.e., derailment coefficient, based on the measurement signals obtained from instrumented wheelsets. The blind signal separation (BSS) and method of independent component analysis (ICA) are applied. Verification is carried out on the example of the wheelset of freight wagon, based on the wheel's FEM model. The obtained results confirmed a high efficiency and accuracy of the developed algorithm, whereby estimated error of inverse identification is less than 5%.

Keywords: inverse determination; wheel-rail interaction forces; derailment coefficient; experimental testing; running safety; railway vehicles; instrumented wheelset.

Reference to this paper should be made as follows: Bižić, M. and Petrović, D. (2022) 'Algorithm for inverse determination of derailment coefficient by using instrumented wheelsets', *Int. J. Heavy Vehicle Systems*, Vol. 29, No. 5, pp.503–517.

Biographical notes: Milan Bižić is Assistant Professor and Vice-Dean for Science and Research at the Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac, Serbia. With more than 15 years of experience, he specialised in the field of railway engineering and experimental testing of mechanical structures. He published more than 60 scientific papers in renowned international journals and international conferences. He participated in several domestic and two international projects. He is a permanent reviewer in the few most famous world journals in the field of measurement and experimental mechanics.

Dragan Petrović is a Full Professor at the Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac, Serbia. He is a longtime chief of the Railway Vehicles Center as well as Department for Machinery design at the same Faculty. With more than 35 years of experience, he specialised in the field of railway engineering and experimental testing of mechanical structures. He published more than 150 scientific papers in the