

## APPLICATION OF NUMERICAL SIMULATIONS TO TEST THE INFLUENCE OF THE STIFFNESS OF THE DEVICE FOR THE MEASUREMENT OF THE DIAMETER OF THE ROLLING CIRCLE OF THE WHEELSETS ON THE ACCURACY OF PERFORMED MEASUREMENTS

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### Introduction

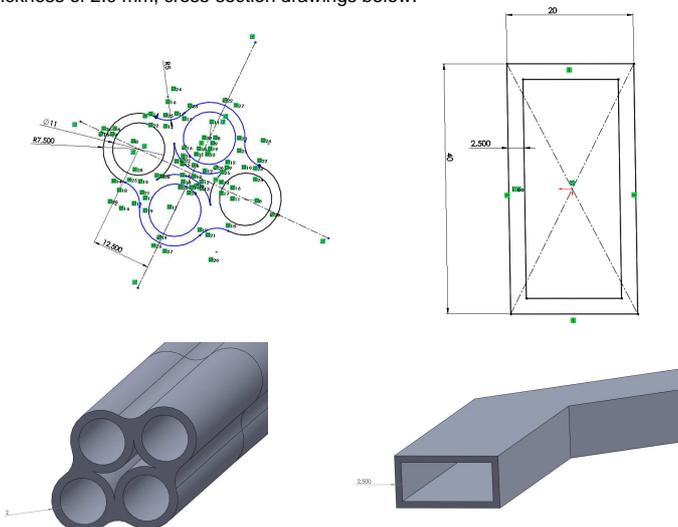
In rail transport, one of the most important problems encountered is to maintain trouble-free operation and a high level of safety of rolling stock operation. It is important to measure the diameter of the running circle of wheelsets. The rolling stock users generally assume an acceptable difference in the diameter of the rolling circle in the wheel set between the two wheels (wheel discs) of the wheelset less than or equal to 0.5 mm. In fact, the implementation of such measurements by hand devices is difficult and can be burdened with a large measurement error resulting from insufficient stiffness of the device's bow. For example, when measuring wheeled sets with a hand wheel diameter measuring instrument, wheel sets constructed in accordance with the industry standard BN-82 3509-13 "Standard gauge wagons and tenders." Diameter gauge on the rolling circle of sets of wheels and the company standard ZN -00 /PKP-3509-09 "Company standard. Rolling stock. "Wheel diameter measuring device" there may be differences in the diameter measurements of the running circle of the same wheel in excess of the 0.5 mm permissible value. Since the measurement of the diameter of the rolling circle of one wheel disk of the wheelset can exceed the permissible value of 0.5 mm, it makes it difficult to correctly determine the difference in the diameters of the running circles of both wheel disks in the wheel set. The instruction manual for measuring the diameter of the wheel circle of wheelsets describes the correct method of making the measurement as being performed in a horizontal position, grasping the measuring instrument with both hands at both ends of the bail. Such a method can be carried out only when measuring wheeled sets. When measuring the diameter of a rolling circle in a different way than provided in the instrument's manual, the differences in the diameter measurements of the running circle of the same wheel can be even greater.

### Research problem and research method

In this paper the attempt to explain the problems encountered during practical implementation of measurements of the diameter of the wheel circle of wheelsets with the use of a hand-held instrument built in accordance with the standards (boom cross section of welded four thin-walled tubes) and the instrument was presented using the simulation results of the "under-load" simulation made not in accordance with standards (with a rectangular section of a thin-walled profile of the bow).

### Results

For the FEM simulation, two types of cross-sections of the wheel diameter measuring device brace have been adopted, a rectangular section of a thin-walled profile with a wall thickness of 2.5 mm and a cross section of welded four thin-walled tubes with a wall thickness of 2.0 mm, cross-section drawings below.

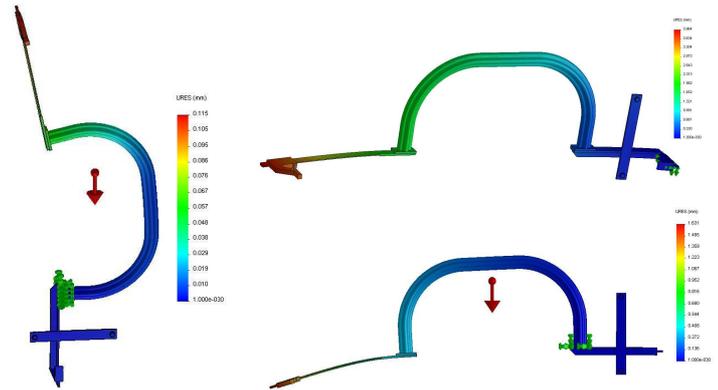


### Abstract

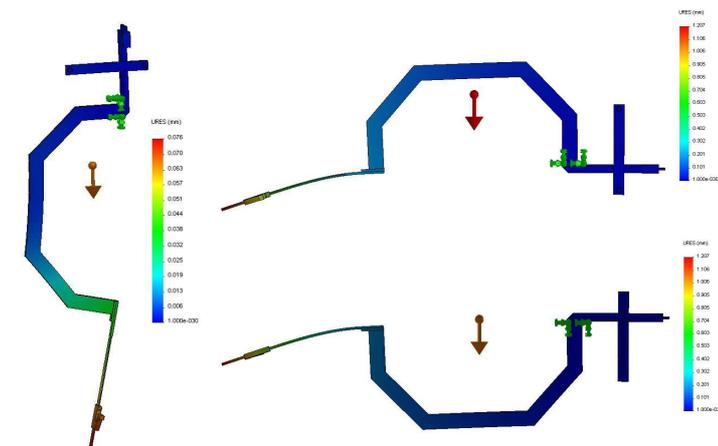
The use of numerical simulations is very helpful in determining the influence of stiffness of the device for measuring the diameter of the wheel circle of wheelsets on the accuracy of measurements. Presented considerations suggest small, insufficient stiffness of the device and indicate the need for further detailed testing of the existing measuring instruments for the measurement of the circle diameter of the wheelsets. There should be validated measurement methods and put them into service for users.

The following figures show the results of FEM simulation of static displacements of the devices measuring the diameter of a rolling circle of wheel sets loaded with "under their own weight" forces

a) with a bail consisting of a profile of welded four thin-walled tubes,



b) with a bail made of a rectangular thin-walled profile.



### Applications and Summary

The obtained results confirm the small, insufficient stiffness of the device's bow and indicate the need for further detailed examination of the construction of existing measuring instruments for measuring the diameters of the running circle of wheelsets. It is necessary to validate measurement methods, measurement methods and introduce them to exploitation for users. It is necessary to carry out further research in order, for example, to select new construction materials for the preparation of the device, in particular the bail, and to select other variable cross-sections and shapes of the bail of the measuring instrument.

### Bibliography

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