

Spring-Based Weight Determination System for Railway Wagons: Leveraging Suspension Compression and Hooke's Law Analysis

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Abstract—This paper proposes a novel method for real-time wagon weight measurement in the railway industry, specifically targeting open wagons like BOXNs used for coal transportation. This approach leverages the existing suspension system within wagon trolleys, equipped with spring nests for axle load support. The key innovation lies in utilizing spring compression to determine the total wagon weight.

The methodology hinges on measuring the decrease in bolster height, which directly translates to spring compression due to the wagon's weight. A simple yet effective mechanism is presented: a rod attached to the wagon bottom with a pivoted end and a potentiometer attached at the pivot point. As the bolster lowers, the rod angle changes proportionally to the spring compression.

Hooke's Law is then employed to calculate the force acting on the springs based on the measured compression and their known stiffness constants. By summing the forces exerted on each spring within the nest, the total force acting on the trolley, and consequently, the entire wagon, can be determined.

This method offers several advantages. It utilizes existing infrastructure, eliminating the need for additional weighing bridges. It provides real-time weight data, enabling dynamic monitoring and prevention of underloading or overloading. Finally, the system is simple, cost-effective, and readily adaptable to existing railway infrastructure.

This paper presents the theoretical framework and proposes further research to refine the calibration process, account for various spring configurations, and validate the system's accuracy through field testing. This innovative approach has the potential to revolutionize wagon weight measurement and improve overall efficiency and safety in the railway industry.

Index Terms—component, formatting, style, styling, insert

I. INTRODUCTION

This document is a model and instructions for L^AT_EX. Please observe the conference page limits.

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$$a + b = \gamma \quad (1)$$

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Please use “soft” (e.g., `\eqref{Eq}`) cross references instead of “hard” references (e.g., (1)). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don’t use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

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- There is no period after the “et” in the Latin abbreviation “et al.”.
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An excellent style manual for science writers is [7].

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The class file is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left

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TABLE I
TABLE TYPE STYLES

Table Head	Table Column Head		
copy	Table column subhead	Subhead	Subhead

^aSample of a Table footnote.



Fig. 1. Example of a figure caption.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an

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ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks . . .”. Instead, try “R. B. G. thanks. . .”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

REFERENCES

Please number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first . . .”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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