A State-of-the-Art Review of Measurement Techniques on Tire–Pavement Interaction Noise

Tan Li

PII: S0263-2241(18)30583-9
DOI: https://doi.org/10.1016/j.measurement.2018.06.056
Reference: MEASUR 5673

To appear in: *Measurement*

Received Date: 15 April 2018
Revised Date: 22 June 2018
Accepted Date: 25 June 2018

Please cite this article as: T. Li, A State-of-the-Art Review of Measurement Techniques on Tire–Pavement Interaction Noise, *Measurement* (2018), doi: https://doi.org/10.1016/j.measurement.2018.06.056

A State-of-the-Art Review of Measurement Techniques on Tire–Pavement Interaction Noise

Tan Li[1, 2]

[1]Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA 24060, USA

[2]Maxxis Technology Center, Suwanee, GA 30024, USA

[1]Corresponding author

E-mail: [1]*L@vt.edu*, [2]*tli@maxxis.com*

Abstract

Modern research on tire–pavement interaction noise (TPIN) started approximately in the mid-1970s as engines became less noisy and the aerodynamic design of vehicle bodies was optimized. Currently, TPIN dominates for passenger vehicles above 40 km/h, and 70 km/h for trucks. There are a number of different measurement techniques to quantify TPIN. In this study, the measurement techniques were reviewed and divided into three categories based on the test environment: roadside, on-board, and lab. The measurement techniques have evolved from simple overall sound pressure level tests to more accurate on-board sound intensity tests, and then to sound field holography in the lab. For each technique, the equipment used, measurement setup and standard if available, measured parameters and data processing, sound field category and major noise source, and advantages/disadvantages were discussed. Finally, suggestions on the selection of measurement techniques were given.

Keywords: Tire noise; Measurement technique; Roadside measurement; On-board measurement; Lab measurement

1. Introduction

Tire–pavement interaction noise (TPIN) modeling, including its measurement techniques, has been extensively investigated since the 1970s (Li et al., 2018 [1]). The measurement of TPIN is very important for noise data analysis, investigation of noise generation mechanisms, and validation of the TPIN model.

There are a number of different techniques for measuring TPIN. Each method has its advantages and disadvantages, and is applied differently under different situations. These methods can be divided into different categories according to different criteria, as listed in Table 1.

Table 1: Category of TPIN measurement techniques

Criterion	Measured Parameter	Sound Field	Acoustic Equipment (Instrumentation)	Test Environment	Measured Noise Source	Standardization
Category	Sound pressure, sound intensity, sound power	Near-field, far-field	Microphone, intensity probe, microphone array	Roadside, on-board, lab	TPIN, vehicle, traffic	Standardized, non-standardized