

Measurement

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Stress-In-Motion (SIM) system for capturing tri-axial tyre–road interaction in the contact patch

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Abstract

A unique measuring system for the quantification of tri-axial (3-D) tyre contact force (or stress) distributions was designed, developed and used in several studies since 1994. The uniqueness of the system is defined by a textured measuring surface in order to represent a typical “textured” road surface. The system is referred to as the Stress-In-Motion (SIM) system. A single SIM measuring pad testing area comprises a total of 1020 supporting pins and a transverse array of 21 sensing elements, covering the entire tyre contact patch with in a single run. The SIM pad measuring system is modular in concept, allowing multiple SIM measuring pads to be used for e.g. wide base truck tyres, or a dual tyre configuration, or full axle measurements – using a quad SIM pad measuring system configuration. Tyre contact force (or stress) distributions are simultaneously captured in the three orthogonal directions X, Y and Z for a single, dual or full axle truck tyre configuration. Each of the sensing elements has a 9.7 mm diameter circular contact surface area (-73.9 mm^2) and is dimensionally optimised, allowing measurements in various tyre rolling conditions on a textured measuring surface. The textured surface induces some pre-conditioning of tyre–road contact properties, as it has small gaps around all supporting and measuring pins. The system is installed flush with the road surface, preferably on a rigid support base, and can be used for real tyre (or truck) rolling conditions. A single SIM measuring pad contains 63 strain measuring channels (3x21) for the sensing elements. Aspects such as SIM system design, sensing element calibration, system usage and outputs of specially developed software are illustrated. Several results of tri-axial road contact stress distributions are also presented.