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Innovative Tyre Testing Platforms and Measurement Systems for Vehicle Applications

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Tyre testing plays a crucial role in automotive engineering, since the predictive capability of handling, ride, durability, and safety models strongly depends on the tyre behaviour. Tyre testing has to be addressed as a rigorous methodological framework aimed at measuring forces, moments, stiffness properties, rolling losses, and critical operating conditions through both dedicated indoor facilities and instrumented in-field vehicles. The development of innovative test rigs and measuring devices capable of extending the experimental observation of tyre behaviour is required. Early research work focused on six-axis measurement systems for identifying the forces and moments transmitted at the wheel hub. Subsequent studies demonstrated the feasibility of directly measuring tyre-road interaction through proprietary measuring wheels for farm tractors and through smart wheels for motorcycles, thus enabling the acquisition of tyre characteristics under realistic combined operating conditions.

More recent developments are test platforms such as MoLAS designed to provide a more comprehensive characterization of tyres, overcoming limitations of traditional outdoor facilities. In parallel, related studies on rolling resistance and tyre-rim interaction show that tyre testing has to be an integrated process linking measurement and model development and calibration.

Advanced tyre testing must combine accurate sensing, carefully designed experimental rigs, and physically grounded modelling tools in order to supply reliable data for vehicle dynamics analysis and subsystems optimization. Such an approach is essential for the development of safer, more efficient, and more robust vehicles across automotive, motorcycle, agricultural, and lightweight mobility applications.

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