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RIDER'S BEHAVIOUR MODELLING IN MOTORCYCLE DYNAMIC SIMULATIONS

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ABSTRACT
The interdisciplinary nature of the motorcycle–rider system makes the modelling and simulation process complex. Moreover, pre-crash and crash situations make its behaviour even more complicated. Developing a well-defined methodology linking multi-body modelling, finite elements models, control theory, models based on experimental data from real tests/scenarios is one of the ways to solve this problem.
A part of the conducted research is developing motorcycle-rider model, which plays a key role in the system level motorcycle road behaviour simulations. In contrast to the driver model of a four wheels vehicle, which are often modelled as constant mass or even omitted without significant influence on vehicle dynamics, the rider's behaviour in motorcycle or more generally, powered two wheelers (PTW) vehicle analysis, has to be taken into account. Proper motorcycle steering and stabilizing requires not only changes in handlebar's orientation (changes of the steering angle) but also changes in the rider's position, (changes of the rider's roll angle).
Many PTW models currently used in simulations define riders as one degree of freedom (DOF) inverse pendulum (IP). The rider's body parts are modelled mainly for visualisation purposes. In some cases (i.e.: simulations of the heavy motorcycles) such models allow for the simulations of standard road manoeuvres but in pre-/crash situations or small PTWs' simulations, obtained results can be inaccurate.
The paper presents a process of developing human body model for motorcycle dynamics simulations, which focuses on solving forward and inverse kinematic problem for such system. Next implementation process in Matlab/Simulink environment and the results of the simulations motorcycle-rider system are presented.