Truck Bond Graph Modelling Integrating Both Multibody and Functional Approaches

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Résumé

The heavy-duty truck industry is undergoing significant technological developments. These developments aim at improving truck performances in terms of vehicle dynamics behaviour, safety, and energy efficiency leading to disruptive innovations. Functions that used to be treated separately, such as steering, braking systems, suspension, power train and engine, must now be more and more treated in synergy. Therefore, improving vehicle design requires a deep understanding of its architecture, its various systems and their complex interconnections. In particular, the chassis which all vehicle subsystems are connected, is of central interest. This paper addresses the construction of a six wheels heavy-duty truck model. The truck has a central drive axle and a steered front axle. It has 3D motions and the different parts are considered as rigid bodies. The model of the link between the truck body (sprung mass) and the spindle (unsprung mass) is based on a functional approach, leading to a domain knowledge model (namely vehicle dynamics). It consists of a mathematical model derived from the kinematical relationships between some key velocities and the degrees of freedom. This differs from the "organic" approach used in generic multi-body modelling, which considers all the bodies and kinematic joints constituting the chassis (3).

Mots-Clés: Bond graph, Vehicle dynamics, Functional modelling, Multibody modelling

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