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Structural Evaluation of Lithium-Ion Battery Packs in the View of a Dedicated Regulation for Working Vehicles

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Lithium-ion battery packs in agricultural work machinery currently lack dedicated regulatory standards, in contrast to battery electric passenger cars, where regulations define specific structural and functional safety requirements. This study aims to evaluate, through a finite element method (FEM) structural model, whether the battery pack—developed by our research group in collaboration with industrial partners and installed on a prototype working electric work vehicle—can satisfy the homologation requirements imposed on battery electric passenger cars by the respective regulation. Recognizing that agricultural working vehicles are subjected to operating conditions that differ significantly from those of passenger cars, the investigation further examines the structural behavior under a critical rollover scenario. Forces acting on the vehicle structure during this loading condition are derived from a multibody dynamic model, and the corresponding deformations on the battery pack are quantitatively assessed with FEM. The results of this study are expected to provide valuable insights toward the development of tailored regulatory frameworks for the certification of electric work vehicles in the agricultural sector.

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