Corbera Caraballo, Sergio; Fernandez, Roberto Alvarez
A performance-based design framework for enhancing decision-making at the conceptual phase of a motorcycle rear suspension development. (English) Zbl 1457.90143 Optim. Eng. 21, No. 4, 1283-1317 (2020).

Summary: The functional design of a motorcycle rear suspension has become a complex process which involves different engineering disciplines such as computer aided design, structural analysis or multibody simulations. As a consequence of this multidisciplinarity, its development process is surrounded by multiple inter-related aspects and uncertainties which can compromise the feasibility of the solutions and hence making it difficult to foresee a priori the most appropriate design directions. This paper proposes an integrated methodology that supports early stage design decision-making for motorcycle rear suspensions by providing a rapid generative mechanism of feasible solutions with performance feedback for multiple requirements. The proposed framework integrates an object-oriented representation of the rear suspension with an adaptative design space approach for enhancing the capability to generate a variety of feasible solutions. A generative system coupled with the NSGA-II algorithm is proposed as responsible for exploring and managing the optimal functional design. The workflow has been structured in such a way all the design actions are conducted automatically. A case study of a Premoto3 rear suspension design is included in order to illustrate the effectiveness of the presented framework.

MSC:
90C29 Multi-objective and goal programming
90C90 Applications of mathematical programming

Keywords:
functional design; generative grammars; evolutionary algorithms; motorcycle design; computational design synthesis

Software:
Python; Matlab; top.m

Full Text: DOI

References:
[34] Pugliese, MJ; Cagan, J., Capturing a rebel: modeling the Harley-Davidson brand through a motorcycle shape grammar, Res Eng Des, 13, 139-156 (2002). doi:10.1016/S0045-7949(98)00133-3


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