The Effects of Manufacturing Processes on Powertrain Design Decisions

by

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ABSTRACT

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Traditional powertrain design is based on the linking of physical parameters to performance metrics through advanced simulation tools. The involvement of manufacturing processes in early product development requires consideration of uncertainties in physical parameters and cost-benefit analysis due to the use of advanced machining technology. This thesis presents two case studies in ground vehicle design to show the effects of manufacturing processes on powertrain design decisions.

The first case study concerns the design of an engine intake manifold and focuses on the tradeoffs between benefits and costs due to applying abrasive flow machining processes. Enhanced powertrain performance and costs in equipment and operation considerations are modeled as a microeconomic optimization problem.

The second case study concerns the design of a fuel injector nozzle, where uncertainties in manufacturing processes are addressed by means of probabilistic optimization. The fuel injector nozzle is designed to meet stringent emission requirements without deteriorating performance.