Data-Driven Modeling of Forming Effects for Crash Simulations

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In modern vehicle development, crash simulation is of central importance for vehicle safety. Conventional methods for modeling material properties and distributions face significant challenges, especially when considering manufacturing-related effects. This paper presents an innovative approach that uses artificial intelligence (AI) to parameterize whole vehicle models in crash simulations.

The proposed method aims to accurately capture the influence of the deep drawing process on component properties, in particular sheet thicknesses and plastic strains, and to integrate these factors into crash simulations. To achieve this, AI models are developed and trained to understand the complex relationships between the manufacturing processes and the resulting component properties. By using data sets from low-fidelity and high-fidelity simulations, the AI can accurately predict the properties of components in the final vehicle assembly.

The results show that the inclusion of these manufacturing-related properties leads to significantly more realistic crash simulations. This improvement enables more accurate predictions about the structural behavior of the vehicle under crash conditions and thus contributes to greater safety and efficiency in vehicle development. The fusion of AI with manufacturing data thus represents a significant advance for numerical simulation and the digital development of vehicles.