

## Case Study: BASF Polyurethanes

# Semi-automated Design of Jounce Bumpers for Shock Absorbers

BASF Polyurethanes GmbH in Lemförde is Europe's market and technology leader in polyurethane systems and specialty plastics. With our market and customer orientation, we research, develop, produce and distribute high-quality polyurethane plastic solutions for almost all industries and sectors.

### The challenge

The development of jounce bumpers at BASF is a complex and time-consuming task. Engineers have to take into account numerous design requirements, such as behavior under load, a wide range of different parameters and limited installation spaces. The existing development process is currently accelerated by using historical data to adapt existing designs to new requirements. The challenge of the project is to develop a data-driven approach that allows the design processes to be partially automated while ensuring the quality and performance of the jounce bumpers.



**The project has shown the limitations of current ML systems and the need for new approaches. The identified solution is not yet final, but it shows a lot of potential and has helped us in our search for suitable ML solutions. A completely finished solution was never the goal, but the result achieved a good match with little input data.«**

**Mario Wolff**  
Group Leader Product Lifecycle Services

## Joint work

The collaboration between Fraunhofer IPK and BASF focused on the partial automation of the design process of jounce bumpers using artificial intelligence.

Together, the team analyzed the existing data and developed an approach to train an AI model. Thousands of jounce bumper designs were generated automatically and BASF provided their behavior through simulation in the form of a load-displacement diagram.

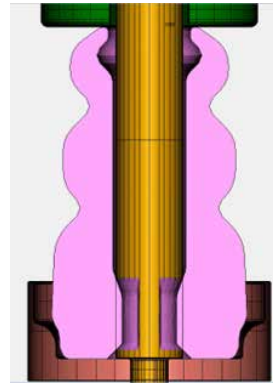
Fraunhofer IPK developed a neural network to predict suitable geometries based on customer requirements. All steps were coordinated in close partnership, because the domain knowledge of BASF colleagues is crucial for a well-functioning AI model.

## The solution

Together, an innovative approach to partially automate the development of jounce bumpers was presented, in which synthetic data is used to train the AI.

Geometry is described by splines, which allow for a wide variety of designs. A neural network was trained to learn the relationship between the requirements for the characteristic curve, i.e. the behavior under load, and the corresponding geometries.

Despite the challenges posed by the need to precisely match the requirements, the project demonstrates the potential of AI to increase efficiency and to find a suitable initial design more quickly.



*The trained AI model optimizes the geometry of the jounce bumpers (shown here in cross-section) to achieve the desired load-displacement characteristic.*

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*In addition to shock absorbers, jounce bumpers are essential for a car's driving comfort. Partial automation significantly simplifies their design.*

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### Further information:

[www.ipk.fraunhofer.de/en/media/futur/futur-2023-2/ai-tailored-wish-fulfillment.html](http://www.ipk.fraunhofer.de/en/media/futur/futur-2023-2/ai-tailored-wish-fulfillment.html)



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## About Fraunhofer IPK

With the help of application-oriented research, we develop solutions along the entire industrial value circle.

Our guiding idea is a digitally integrated production in which man and machine interact on the basis of data and can thus adapt flexibly and proactively to changing requirements.