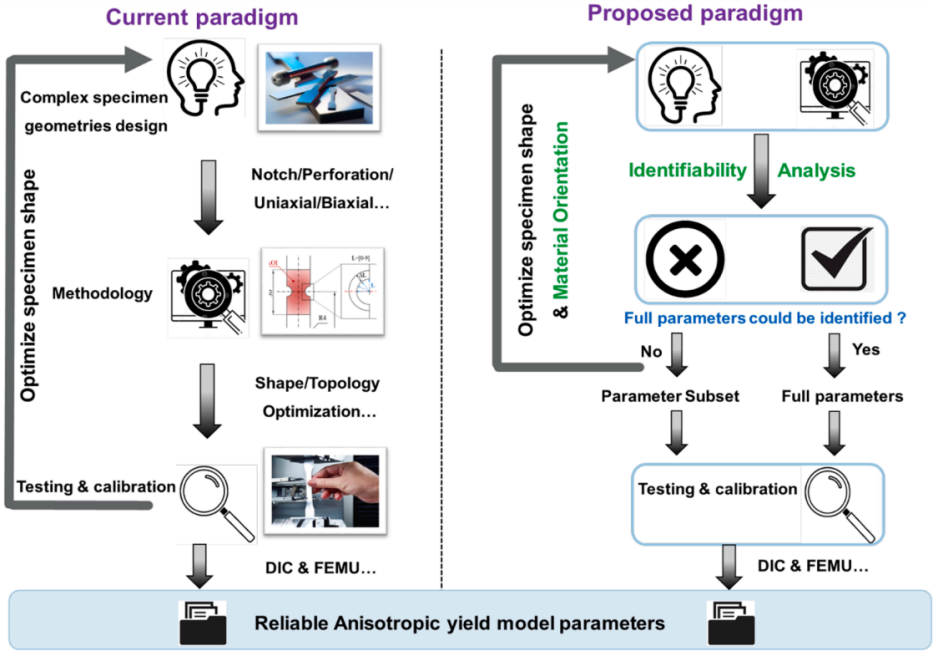
Project

NEWSLETTER

VForm-xSteels

Toward virtual forming and design: Thermomechanical characterization of high strength steels through full-field measurements and a single designed test



One of our latest developments in the project...

Currently, the inverse identification of advanced anisotropic yield functions through FEMU and VFM is hampered by non-uniqueness issues. The problem is likely to be rooted in the underlying gradient-based optimization algorithms and a non-conventional test that not sufficiently activates the sought model parameters of the anisotropic yield function. The paper "Parameter identifiability analysis: Mitigating the non-uniqueness issue in the inverse identification of an anisotropic yield function" discusses the challenges of calibrating anisotropic yield functions, specifically the Yld2000-2d model, for accurately predicting material behavior. It introduces a parameter identifiability framework to assess model parameters' sensitivity and interactions, using virtual experiments on a notched tensile specimen to maximize strain field inhomogeneity.

The method aims to improve the uniqueness of material model identification, crucial for simulations in mechanical design, and confirms the approach's effectiveness through actual experiments.

The effectiveness of identifying material parameters depends on their sensitivity. Low-sensitivity parameters can still be precisely identified if they're part of a subset with minimal interaction effects. High-sensitivity parameters can be identified even with high collinearity indices. These insights suggest a dynamic identification approach using specific parameter subsets to enhance uniqueness. Additionally, the orientation of material axes is crucial in experiments for identifying anisotropic yield functions, where the right orientation choice can significantly boost identifiability. Further exploration of these findings is planned for future research.

Authors: Y. Zhang, A. Van Bael, A. Andrade-Campos, S. Coppieters

Find more by clicking the icon below:

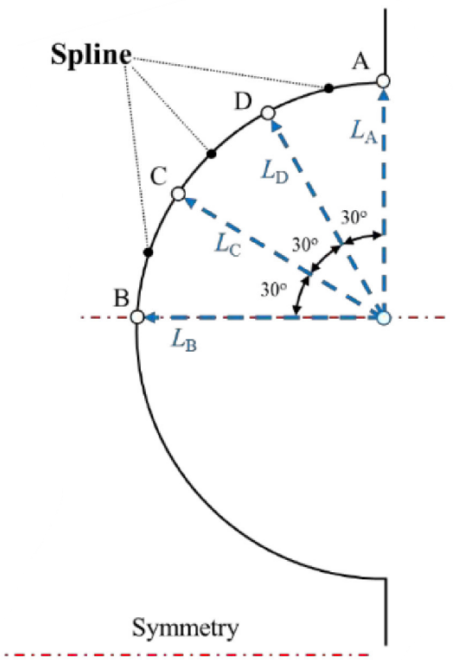
Parameter identifiability analysis: Mitigating the non-uniqueness issue in the inverse identification of an anisotropic yield function

Enhancing Plastic Anisotropy Identification

In a research recently published in the International Journal of Mechanical Sciences, researchers have made significant strides in enhancing the calibration of anisotropic constitutive models for sheet metal. Key highlights include:

- The integration of advanced mechanical tests with strain field analysis, offering a more efficient and accurate approach to model calibration.
- The crucial role of material orientation and test shape in the precise identification of material parameters.
- The successful application of Finite Element Model Updating (FEMU) and synthetic Digital Image Correlation (DIC) data in validating these methodologies.
- The development of an optimization method for mechanical test designs, aiming to improve the identifiability of material parameters.

The authors state that future work will embark on integrating metrological aspects and measurement noise within the framework of identifiability.



Design variables for shape optimization

Authors: Y. Zhang, S. Gothivarekar, M. Conde, A. Van de Velde, B. Paermentier, A. Andrade-Campos, S. Coppieters

Find more by clicking the icon below:

Enhancing the information-richness of sheet metal specimens for inverse identification of plastic anisotropy through strain fields

Swift Law Parameters and Innovative Testing

In a study presented at ESAFORM 2022, it was introduced a novel approach for identifying Swift hardening law parameters in dual-phase steel. Highlights include:

- Utilizing an innovative heterogeneous mechanical test to produce complex strain and stress states.
- Implementing a Finite Element Model Updating (FEMU) technique, combined with Digital Image Correlation (DIC), for precise parameter identification.
- Achieving accurate calibration of Swift law parameters, showcasing the potential for more efficient material testing in forming processes.

One of the main conclusions of this study is the demonstration of a significant improvement in the accuracy of material behavior prediction, particularly in dual-phase steels, which has profound implications for industrial forming processes.

Authors: M. Conde, J. Henriques, S. Coppieters, A. Andrade-Campos

Find more by clicking the icon below:

Parameter Identification of Swift Law Using a FEMU-Based Approach and an Innovative Heterogeneous Mechanical Test

FEMU and DIC Integration

A research within the scope of this project unveils a novel technique in material science, employing FEMU and DIC for identifying anisotropic yield functions. The main topics that were covered are:

- Utilization of a heterogeneous tensile specimen for maximum strain heterogeneity.
- A novel approach using virtual experimentation to distinguish between DIC and material model errors.
- Emphasis on the selection of accurate anisotropic yield functions for effective identification.

This research represents a significant step forward in material characterization, enhancing the predictive accuracy of simulations.

Authors: Yi Zhang, António Andrade-Campos, Sam Coppieters

Find more by clicking the icon below:

Identification of Anisotropic Yield Functions Using FEMU and an Information-Rich Tensile Specimen

ESAFORM 2022

The 25th European Scientific Association for material FORMing (ESAFORM) Conference, held in Braga, Portugal, featured a Mini-Symposium (MS9) titled "Optimization and Inverse Analysis in Forming."

This session was co-organized and chaired by Matteo Strano (Politecnico di Milano), António Andrade Campos (University of Aveiro) and Sam Coppieters (KU Leuven).

This event took place from April 27th to 29th and the partners were all represented in this occasion. The consortium members gathered for the photographic record presented in the image below:

From left to the right side in the picture:
Standing there's Rúben Lourenço, Mariana Conde, Steven Cooreman, Pascal Lava, António Andrade-Campos, Sandrine Thuiller and Sanjay Gothivarekar;
On the front there's Diogo Henriques, Mafalda Gonçalves, Sam Coppieters, Marco Rossi, Shreya R. Kamath, Yi Zhang and Miguel Oliveira

Consortium Meeting

The University of Aveiro hosted a consortium meeting just days before the ESAFORM event. It took place from April 25th to 26th, where partners attended a welcome session featuring the presence of the head of the mechanical engineering department (DEM), Robertt F. Valente. Various topics were discussed, such as the interim report, the current status of the work packages, and the benchmark preparation.

The Mechanical Engineering Department (DEM) at University of Aveiro (UA)

The partners were firstly reunited at the DEM meeting room:

This project has received funding from:

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Partners

University of Aveiro (UAVR)

University of South Brittany (UBS)

KU Leuven (KUL)

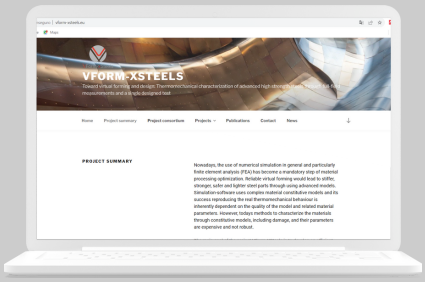
MatchID (MID)

Università Politecnica delle Marche (UNIVPM)

DAF TRUCKS NV (DAF)

Onderzoekscentrum voor Aanwending van Staal nv (OCAS)

Visit the official website of the project:



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