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AI-Driven Optimization: Enhancing Crash Box Design and Structural Health Monitoring

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GEPI Research Group

<https://meaagg.com/gepi>

Scientific and Technological Expertise

- Reverse engineering: digitization of objects with a scanner
- CAD/CAM/CAE
- Modeling, rapid prototyping, rapid tooling
- Virtual and physical modeling
- Mechanical characterization of materials
- Numerical structural simulations
- PLM and LCA Engineering
- Calculation and simulation of fluids in biological organs
- Additive Manufacturing (AM) and Design for Additive Manufacturing
- Structural health monitoring and analysis



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Structural Health Monitoring

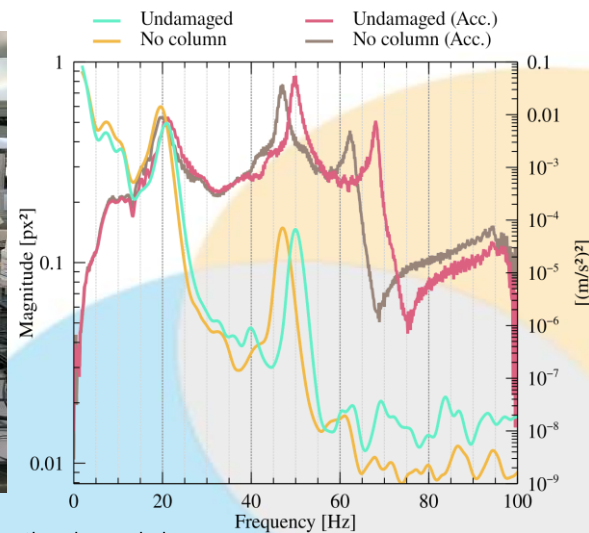
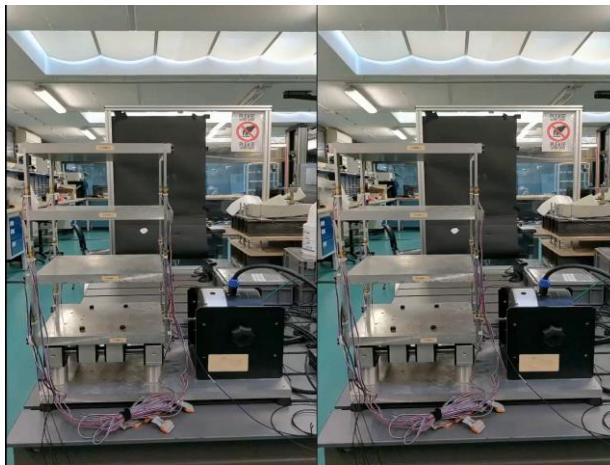
Leverage computer vision and artificial intelligence, specifically Transformers, as non-intrusive and remote intelligent tools for the detection of structural damage.

Wind Turbine in Mecklenburg-Vorpommern – Germany
Collapsed 7th Aug 2023



No magnification

x20 magnification





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STB-VMM: Swin Transformer Based Video Motion Magnification

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Abstract

The goal of video motion magnification techniques is to magnify small motions in a video to reveal previously invisible or unseen movement. Its uses extend from bio-medical applications and deepfake detection to structural modal analysis and predictive maintenance. However, discerning small motion from noise is a complex task, especially when attempting to magnify very subtle, often sub-pixel movement. As a result, motion magnification techniques generally suffer from noisy and blurry outputs. This work presents a new state-of-the-art model based on the Swin Transformer, which offers better tolerance to noisy inputs as well as higher-quality outputs that exhibit less noise, blurriness, and artifacts than prior-art. Improvements in output image quality will enable more precise measurements for any application reliant on magnified video sequences, and may enable further development of video motion magnification techniques in new technical fields.

Keywords: Computer vision, Deep Learning, Swin Transformer, Motion Magnification, Image Quality Ass.



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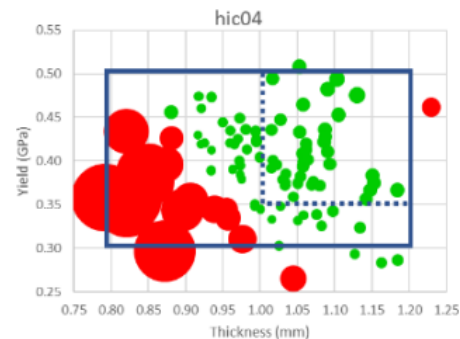
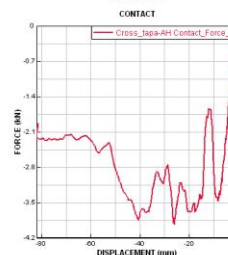
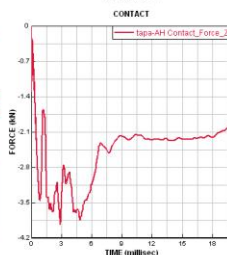
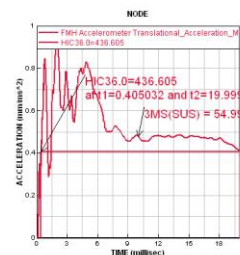
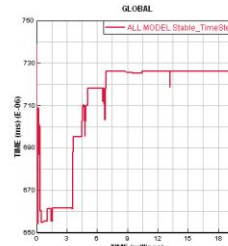
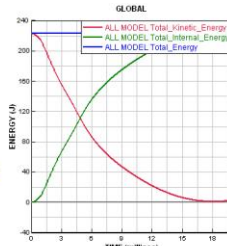
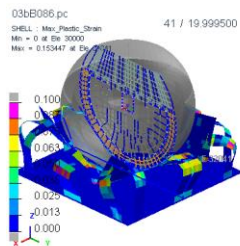
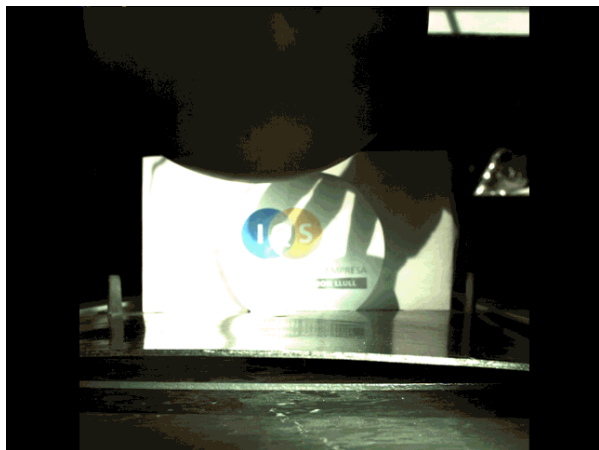
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Enhancing Crash Box Design

Leverage Artificial Intelligence for the creation of secure crash designs aimed at minimizing both vehicle mass and fuel consumption.



Risk from thickness variations

Test and simulation for pedestrian protection



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What we look for:

- Partners interested in the adoption of artificial intelligence techniques in collaboration with stochastic simulations models.
- Partners interested in evaluating cutting-edge technologies such as Neuromorphic Computing for rapid visual data acquisition and analysis in health structural monitoring.
- Partners interested on the development of open-source tools dedicated to data analysis and parameters estimation within the crash investigation and structural health monitoring domains.
- Partners to formulate compelling proposals for both European and national/binational funding opportunities.



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HEU FUNDING

Mutual learning and support scheme for national and regional innovation programmes
 HORIZON-EIE-2024-CONNECT-02-02



Expanding enterprise-academia collaborations
 HORIZON-EIE-2024-CONNECT-02-01

Bio-intelligent manufacturing industries
 HORIZON-CL4-2024-TWIN-TRANSITION-01-01

* The European Institute of Innovation & Technology (EIT) is not part of the Specific Programme

AEI-DFG Call for Joint Spanish-German Research Projects in the Fields of Psychology, Mathematics, Atmospheric Science, Oceanography and Climate Research





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