© Gebhard|Uhl, Fraunhofer IWM

AI for materials fatigue assessment and machine component lifetime prediction

Online Workshop, 24 - 25 November 2021

In materials and component research, artificial intelligence methodologies will lead to massive upheavals in the coming years. The processes of material development, material processing, lifetime prediction and material characterization will change significantly. By combining AI methods and new forms of knowledge representation, the data-based management of product life cycles will take on new qualities. To address this emerging field of research Fraunhofer IWM set up the online workshop »AI Methods for Fatigue Behavior Assessment and Component Lifetime Prediction« on November 24 and 25, 2021.

Manufacturers and operators of facilities and plants are faced with the challenge of ensuring and reconciling performance and economic efficiency as well as the reliability and safety of their systems. This requires suitable monitoring and maintenance concepts plus valid decision-making fundamentals for adapting operating points to changing operating conditions. Prerequisites for this are material models for service life assessment, methods for the qualification of critical components and a sound database.

The combination of AI methods and knowledge graphs introduces new possibilities for the data-based management of product life cycles. With a view to assessing the fatigue behavior of materials and predicting the service life of components, this results in a new quality of predictions and new starting points for reducing failure costs and increasing plant and systems availability.

Renowned experts from science and industry will present corresponding concepts as well as how methods of artificial intelligence and digitalization of materials can be integrated into product development and systems and facilities operation.

Reasons for participation

– International experts from industry and leading research institutions will provide a new perspective on the topic of AI-supported material and component evaluation.

– Discover how lifetime expectancy predictions, material/component development and product lifecycle management are taking on a new quality through the combination of artificial intelligence, data structures and materials modeling.

– Learn how material and component simulation will manifest itself in the future as well as how this will lead to improved decision-making in product development and plant and systems operations.

– Find out about the current state of investigation in an innovative research field and connect with international experts from different disciplines.

Workshop Organization: Fraunhofer Institute for Mechanics of Materials IWM, 79108 Freiburg, Germany, www.iwm.fraunhofer.de

Contact: Thomas Götz, thomas.goetz@iwm.fraunhofer.de, Wiebke Beckmann, wiebke.beckmann@iwm.fraunhofer.de

The workshop is free of charge. Please register on our webpage: **Link**

Online Workshop AI for materials fatigue assessment and machine component lifetime prediction

Program
Wednesday, 24 November 2021

01:00 PM
Opening, Prof. Chris Eberl, Fraunhofer IWM

Collecting and handling of operational data
How can the gap between sensor data and material information be closed? How can information on materials behavior be extracted?

01:30 PM
The need to increase efficiency in the generation and evaluation of fatigue data from operations
Dr. Matthias Funk, Schaeffler Technologies, Herzogenaurach

02:00 PM
Collecting and handling of operational data - status quo and development needs
N.N.

Material Data Structures for AI Applications
What are critical features that foster AI performance? How relates AI to the scale of data structures?

02:30 PM
Representation Learning and Knowledge Graphs
Dr. Mehwish Alam, Leibniz Institute for Information Infrastructure, FIZ Karlsruhe

03:00 PM Break

03:30 PM
A new AI/ML Framework for materials innovation
Prof. Surya R. Kalidindi, Georgia Tech, Atlanta

AI supported Development Processes
How are process aspects from the manufacture of components taken into account in the development with the aim of achieving a high fatigue strength? How can existing data be used? How are fatigue properties predicted in development?

04:00 PM
Deep Learning in Materials Science and Technology
Dr. Tim Dahmen, German Research Center for AI, DFKI

04:30 PM
AI-Accelerated Alloy Design
Bryce Meredig, Ph.D., Citrine Informatics, Redwood City, California

05:00 PM Virtual Get Together

06:00 PM End of day 1

Program
Thursday, 25 November 2021

01:50 PM
Opening, Dr. Christoph Schweizer, Fraunhofer IWM

Evaluating the service life of critical components
Which models need which information? How can existing data be linked (data fusion)? How do testing methods and AI complement each other

02:00 PM
Coping with materials variance using transfer learning
Ali Riza Durmaz, Fraunhofer IWM

02:30 PM
Bayesian geometric learning as a step towards nonparametric metamodeling in multiscale solid mechanics
Pierre Kerfriden, Ph.D., MINES ParisTech

03:00 PM
Digital twins for monitoring purposes
Dr. Jörg F. Unger, Federal Institute for Materials Research and Testing, BAM

03:30 PM Break

The path to a lifespan app
How can material models, AI methods and operating data be linked for lifetime predictions? What would be scenarios of apps in use?

04:00 PM
On the future role of digital knowledge bases/expert systems to support fatigue lifetime predictions
Dr. Christoph Schweizer, Fraunhofer IWM Freiburg

04:30 PM Final discussion

05:00 PM End of the workshop