FACULTY OF ENGINEERING AND ARCHITECTURE

FACULTY OF MECHANICAL ENGINEERING CTU IN PRAGUE

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https://faber-cost.eu/

Fatigue Benchmark Repository - FABER (CA23109)

Introduction

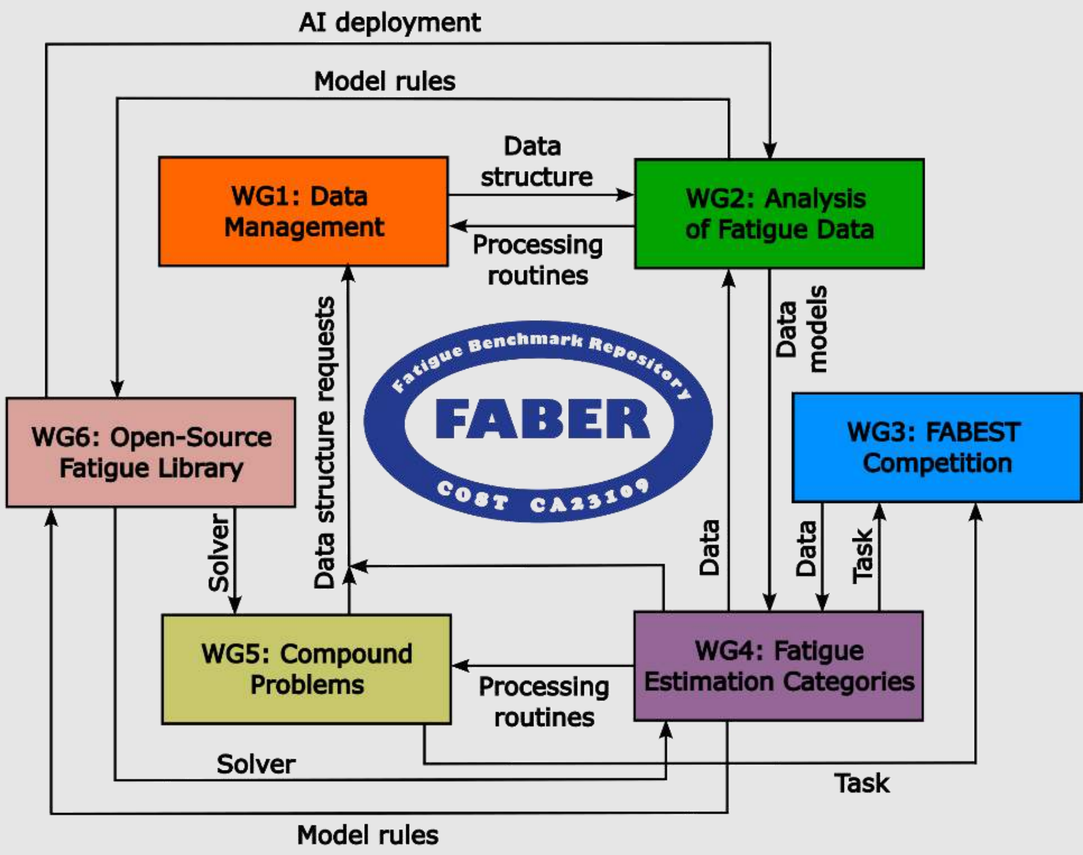
FABER

The FABER (Fatigue Benchmark Repository) Cost Action CA23109 was launched in September 2024 as a networking initiative funded by the COST Association. It is planned to run for four years, until September 2028. At the time of writing, it includes more than 180 members from 37 countries.

The goal of FABER is to improve fatigue life estimation by establishing standardized fatigue benchmarks, fostering collaboration between academia, industry, and fatigue solver developers, and increasing the accuracy and credibility of fatigue analysis. FABER is structured in six WG's as shown on the right.

Challenges in Fatigue Life Estimation

- Fatigue solvers automate calculations but do not improve models.
- Industry relies on old, empirical models fine-tuned to past experience.
- No independent validation of fatigue solvers in industry.
- Academia focuses on novel research, neglecting validation of existing methods.



Working groups

WG 1: Data Management

- Establishes a structured format for experimental fatigue data storage.
- Defines essential parameters and data curation rules for benchmarking.
- Develops protocols for data validation and consistency checks.

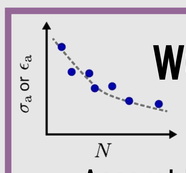
WG 2: Fatigue Data Analysis

- Define benchmarking criteria for evaluating solver performance.
- Investigates Artificial Intelligence & Machine Learning applications in fatigue prediction.
- Ensures statistical rigor in fatigue life estimation methodologies.

WG 3: FABEST Competition

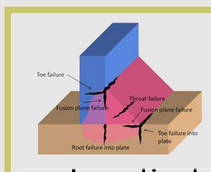
- Organizing a global fatigue estimation challenge to benchmark solvers and various calculation methods.
- Uses real experimental datasets for solver validation.
- Encourages industry-academia collaboration to improve fatigue models.
- Focuses on high-impact fatigue problems like contact fatigue and material effects.

WG 4: Fatigue estimation categories



- Assembling benchmarks for seven fatigue estimation categories (mean stress effect, critical volume effect, load multiaxiality effect, surface integrity, damage accumulation, material anisotropy, low-cycle fatigue)
- Addressing critical knowledge and technology gaps Investigates Artificial Intelligence & Machine Learning applications in fatigue prediction.

WG 5: Compound problems



- Investigates complex fatigue interactions (e.g., additive manufacturing, welding).
- Analyzes real-world fatigue scenarios involving multiple effects.
- Proposes guidelines for future benchmark dataset expansion.
- Bridges the gap between fundamental fatigue models and practical engineering applications.

WG 6: Open-Source Fatigue Library

- Develops an open-source Python-based fatigue solver for benchmarking.
- Integrates benchmark datasets for standardized fatigue predictions.
- Supports researchers in validating fatigue models.
- Encourages collaboration to create an accessible, transparent fatigue analysis tool.

Call to Action

- **Industry**: Insist on independent benchmarking of fatigue solvers to ensure reliability. Participate in FABER's initiatives to improve fatigue estimation accuracy. Support funding efforts for open-access benchmark datasets.
- **Developers**: Engage with researchers to validate fatigue prediction models. Contribute to the development of the open-source fatigue library. Allow transparent benchmarking to build user confidence in solver accuracy.
- **Academia**: Focus on refining and validating existing fatigue models rather than solely pursuing novel research.
  Utilize the benchmark datasets to test fatigue estimation approaches. Collaborate with industry and developers to integrate new findings into practical applications. Join the COST Action: https://faber-cost.eu/ !

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