

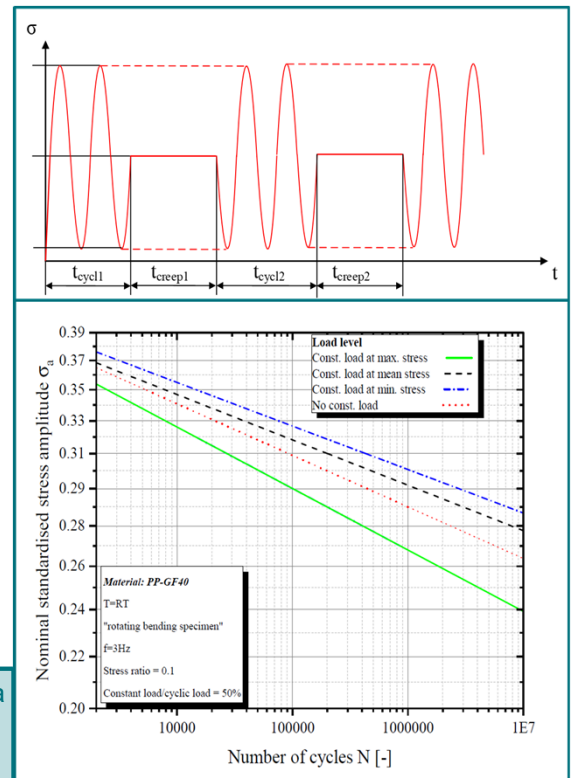
# Influence of viscoelasticity on the fatigue behavior of short fiber reinforced polymers

Gabriel Stadler

## Characterization of creep-fatigue loads on the material behavior

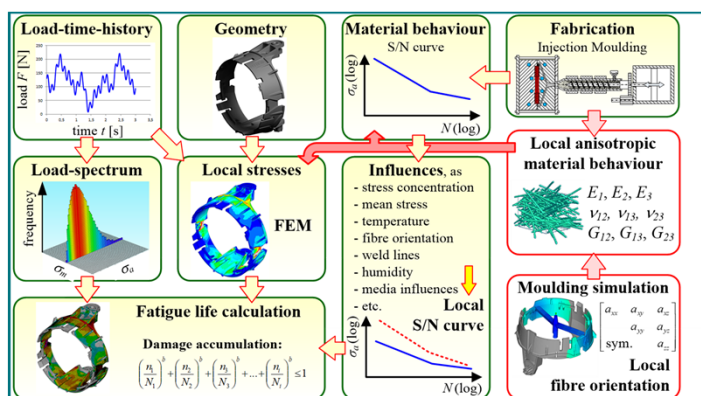
Lightweight structure components for different applications are necessary to reach environmental goals. Since such components are loaded cyclic interrupted by resting times where creep or/and relaxations effects occur. These effects influence the fatigue behavior of short fiber reinforced polymers (sfrp). So, a load sequence was developed to capture the interaction of creep and fatigue loads (Fig. 1).

The load sequence is distributed into constant (creep) and cyclic (fatigue) load blocks. Based on this sequence, the constant load level was switched between the minimum, mean and maximum of the cyclic loading.



**Fig. 1**

Simulation chain for a lifetime estimation of sfrp. This chain covers beside a complex loading sequence, influence parameters like: temperatures, notches, stress ratios, fiber orientation etc.\*



These tests are also performed at higher temperatures. As a result, this effect is more pronounced and corresponds to applicational use. To consider this effect in a lifetime estimation, models are derived and implemented in an existing simulation chain (Fig. 2). Additionally, the effect of frequency, mean stress and fiber orientation on the lifetime behavior are investigated in this research.

**Fig. 2**

Load sequence of the combined tests and resulting S/N curves. Depending on the constant load level, the lifetime will be reduced or elongated for a certain cyclic stress amplitude\*\*.

\*Mösenbacher, A.; Pichler, P. F.; Brunbauer, J.; Guster, C.; Pinter, G.; (2013) Lebensdauerberechnung an Strukturbauteilen aus kurzfaserverstärkten Thermoplasten. In: DVM-Arbeitskreis Betriebsfestigkeit (Hg.) 2013 – Die Betriebsfestigkeit als eine Schlüsselfunktion.  
\*\* Stadler, G.; Primitzhofner, A.; Jerabek, M.; Pinter, G.; Grün, F.; (2020) Investigation of the Influence of Viscoelastic Behaviour on the Lifetime of Short Fibre Reinforced Polymers. In: Polymers. DOI: 10.3390/polym12122874



**GABRIEL STADLER**

Materials Science and Testing of Polymers  
[gabriel.stadler@unileoben.ac.at](mailto:gabriel.stadler@unileoben.ac.at)

**RESEARCH FOCUS:** Fatigue of polymers with focus on short fiber reinforced polymers, computer-aided service life assessments

**PROJECT:** Creep Fatigue Interaction in Performance Polymers at High Temperatures  
**PROJECT PARTNERS:** SKF BV, DSM Ahead BV, Hutchinson S.A., Saudi Aramco Technology Company, Shell Global Solutions International BV, Sabic Petrochemicals (Polymers)  
**FUNDING:** This research forms part of the research programme of DPI, project # 851 Technology Area: D02 Performance Polymers 2.0. DPI, P.O. Box 902, 5600 AX Eindhoven, the Netherlands