# DETERMINATION OF DESIGN LIMITS FOR A TEST BLANKET MODULE UNDER ITER OPERATING CONDITIONS

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Existing structural design criteria (SDC) are based on the material data, which do not consider a possible change of material properties such as the tensile strength and the yield stress after a cyclic loading. The aim of this work is to find out whether the available SDC may also be applied to the EUROFER subjected to operating conditions of the ITER test blanket module (TBM) i.e. thermal and mechanical cyclic loading.

Recent experiments performed at FZK have shown that like other ferritic martensitic steels, EUROFER exhibits softening during the cyclic loading contrary to austenitic steels, which usually harden cycle by cycle. Such softening leads to a remarkable decrease of the lowest stress intensity at a given temperature among the time-independent strength quantities i.e. $S_m$, which is a significant element of the SDC.

Within the frame of the present work, a range of the working temperatures and mechanical loads has been specified for EUROFER under consideration of advanced material properties such as the softening cycle by cycle mentioned above and the creep-fatigue damage with EUROFER-specific parameters using the FE code ABAQUS. Thereby, a user-specified material routine (UMAT) developed and implemented by J. Aktaa has been used to describe the creep-fatigue. The FE model considers the current TBM design, usual and accident ITER operating conditions as well as typical problems related to the TBM development. A comparison of the lifetime assessment results with conclusions obtained by an application of the SDC to results of a linear-elastic simulation allowed a verification of the SDC.