

EURAXLES Project: Small scale fatigue testing for axle steels under CA and VA loads



POLITECNICO
MILANO 1863

DIPARTIMENTO DI MECCANICA

Background

The EU funded project EURAXLES aims at introducing revised axles design concepts by taking into account of service loading conditions and of the experimentally determined fatigue limits, including new materials and methods in order to predict the 'failure probability'.

Thus, assessing the predictive capabilities of fatigue life calculation methods and the transferability of small scale fatigue tests to full scale railway axles would lead to improved fatigue resistance of railway axles with new designs.

Fatigue testing

Fatigue testing with small scale specimens extracted from railway axle segments were performed both under CA and VA loading conditions.

- The fatigue endurance strength under CA loading was assessed by means of a maximum log-likelihood (ML) method.
- Fatigue test spectra were derived by transformation of in-service measured spectra.
- Fatigue testing with small scale specimens under VA loading conditions were performed with applying tests spectra derived by real service conditions.

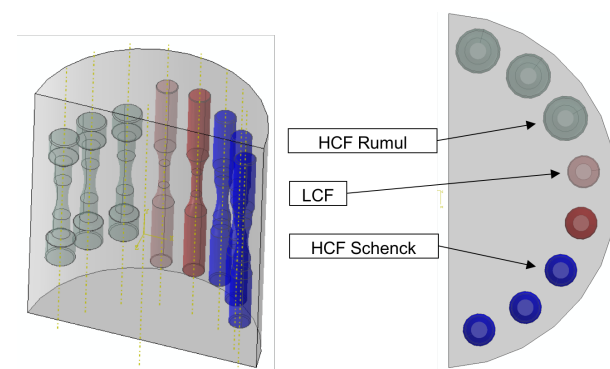
Fatigue assessment under VA loadings

VA fatigue experiments were compared with predictions carried out with the Miner Konsequent methodology for the assessment of fatigue life, so that optimum value of the allowable damage sum could be identified.

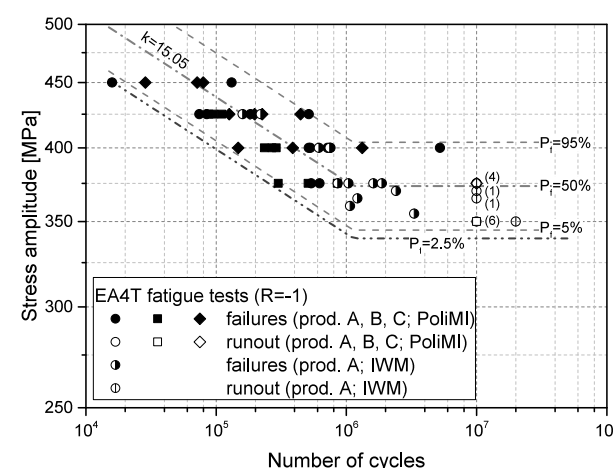
An allowable damage sum $D=0.3$, with calculations performed on the 2.5% percentile of the fatigue curve, as suggested by the FKM guidelines, is proved to be a conservative choice for the safe design of railway axles.

References

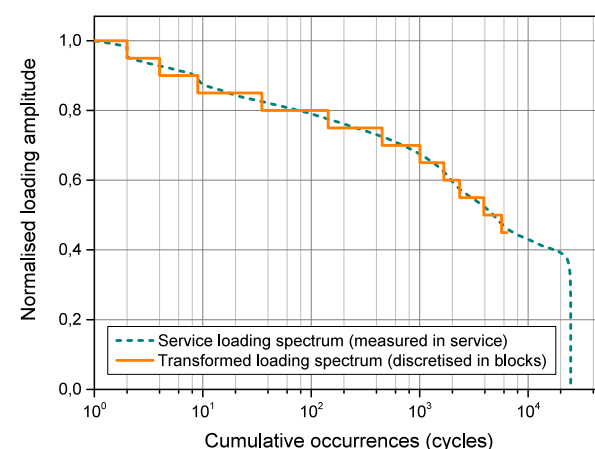
- Beretta, S., and Regazzi, D., 2016, "Probabilistic fatigue assessment for railway axles and derivation of a simple format for damage calculations," Int. J. of Fatigue, 86, pp. 13–23.
- Gänser, H. P., Maierhofer, J., Tichy, R., Zivkovic, I., Pippan, R., Luke, M., and Varfolomeev, I., 2016, "Damage tolerance of railway axles - The issue of transferability revisited," Int. J. of Fatigue, 86, pp. 52–57.
- Beretta, S., Carboni, M., and Regazzi, D., 2016, "Load interaction effects in propagation lifetime and inspections of railway axles," Int. J. of Fatigue, 91, pp. 423–433.



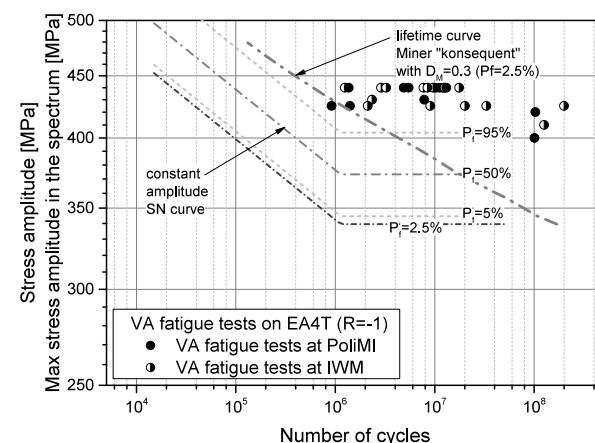
Axles cut-up for small-scale specimens



Fatigue tests with small-scale specimens (CA loads)



From measured loading spectrum to test spectrum



Fatigue assessment under VA loadings

Acknowledgements

This project – led by UniFE – has received funding from the European Union's FP7 research programme under Grant Agreement no 265706

