COMPUTATIONAL MECHANICS 2018
34th conference with international participation
Srní
October 31 - November 2, 2018

Probabilistic approach to prediction of fatigue life

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In recent years, Kliman [4] presented a calculation of the fatigue life distribution function (FLDF). Under laboratory conditions, he considered the scatter of material properties of smooth material samples as well as the various random load processes, see Fig. 1.

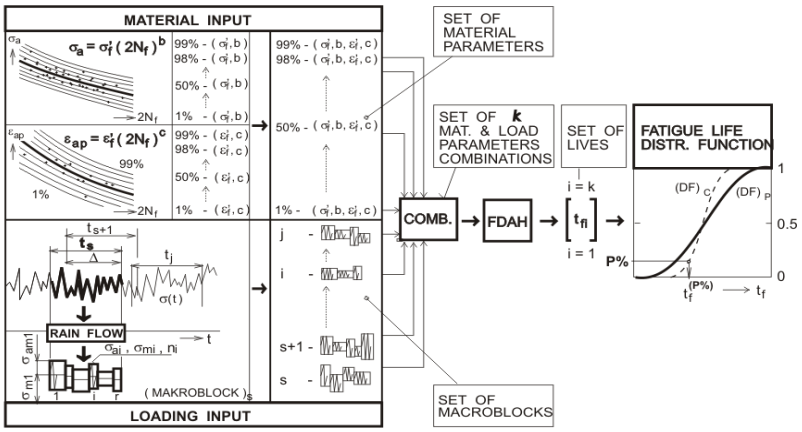

Fig. 1. Schematic procedure for calculating the FLDF by Kliman, [4]

We focused on the scatter of fatigue properties of specific components, see Fig. 2. It can be determined by evaluation of a sufficient number of fatigue tests of an investigated component. Alternatively, e.g. the BS 7608 [1] defines S-N curves of typical structural and technological details for different probabilities of survival. We applied this probabilistic approach and we calculated the FLDFs for several components exposed to real loading.

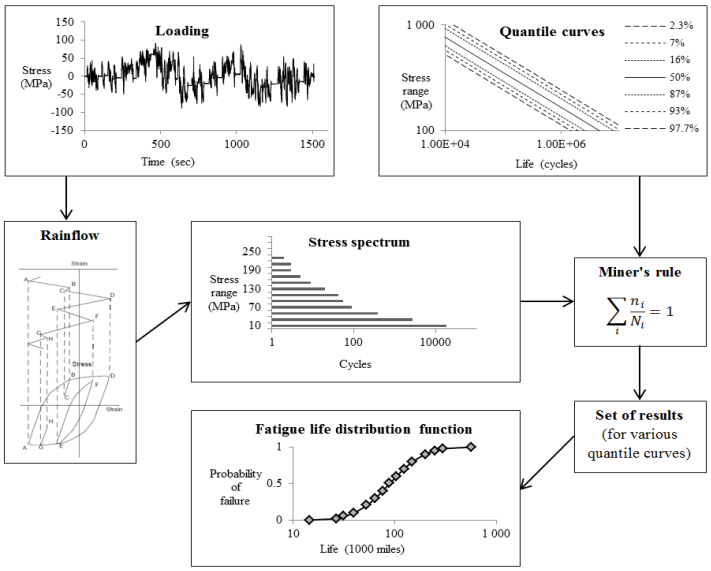

Fig. 2. Schematic procedure for calculating the FLDF of a real component with a scatter of fatigue properties

Fig. 3 shows two case studies. The first example shows the FLDFs that were calculated for a component with occurrence of fatigue cracks. It can be seen that service failures lie between the FLDFs calculated for two "extreme" operating modes, such as driving an empty vehicle (without passengers) and driving a fully occupied vehicle [2]. The second example shows the predicted FLDFs for a bus bodywork node made of different steels. One of the considered material solutions does not meet the required service life [3].

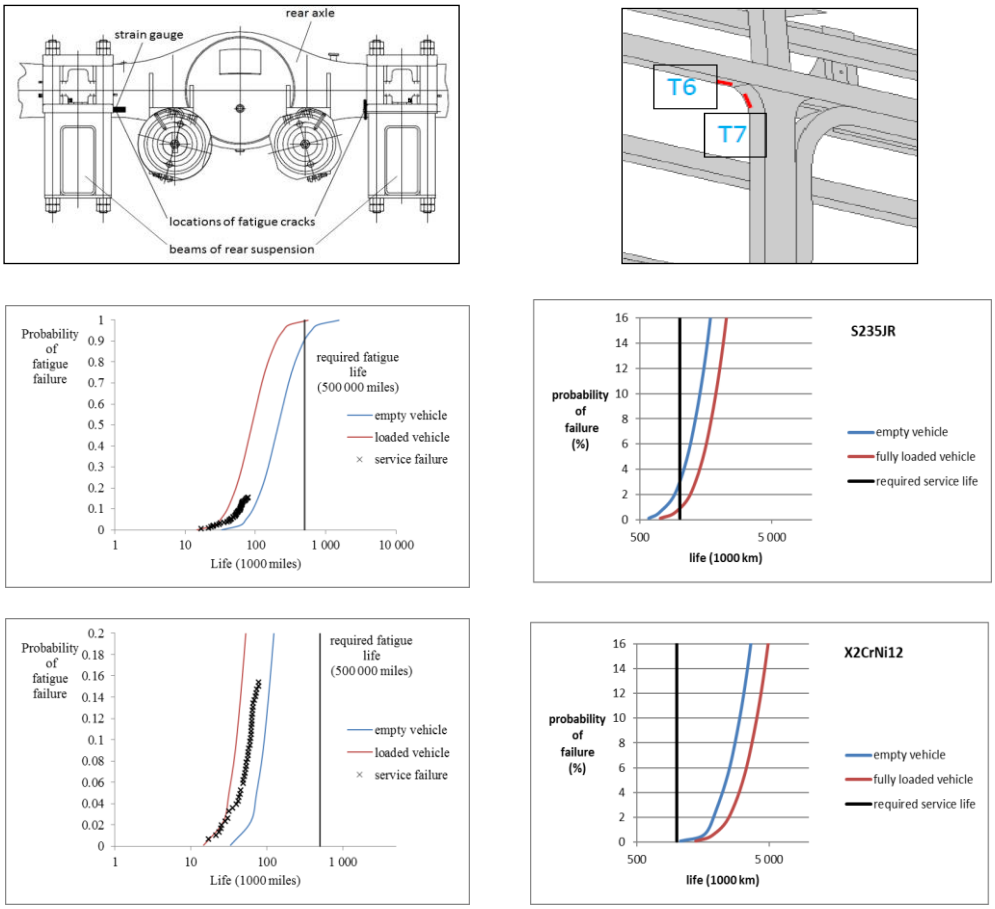

Fig. 3. Comparison of calculated FLDFs of a welded joint of a rear axle with service failures (left); Predicted FLDFs of a bus bodywork node made of different steels (right)

The probabilistic approach to prediction of fatigue life is appropriate for other practical situations. Some case studies will be presented in detail at the conference and in full paper.

Acknowledgements

The work has been supported by the research project LO1502 "Development of the Regional Technological Institute", under the auspices of the National Sustainability Programme I.

References

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