



S-Life - Integrated Static and Fatigue Strength Assessment with Abaqus

According to German FKM Guideline

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PART Engineering – Key Facts



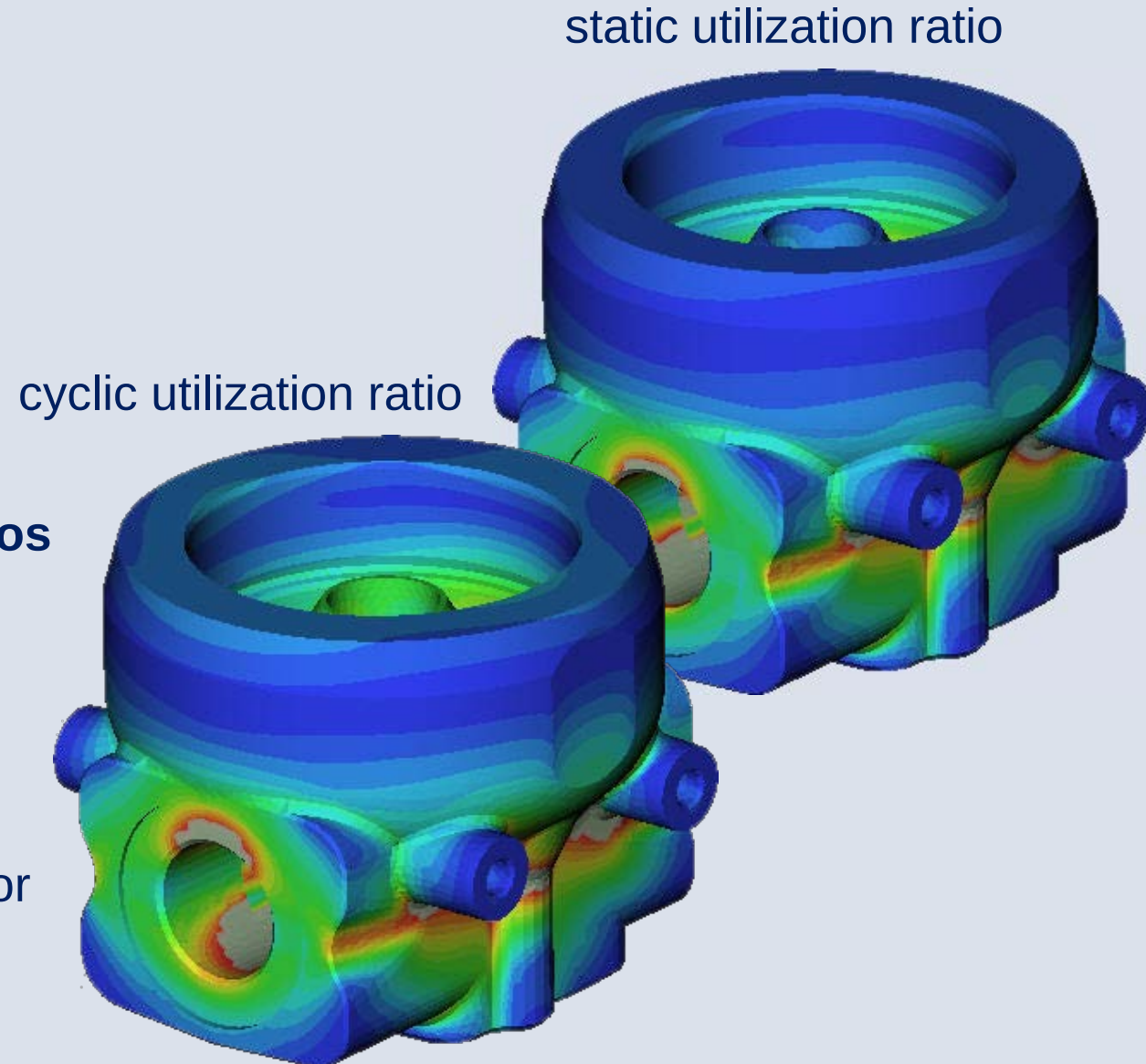
- **Founded** in 1999 as FEM services supplier
- **Focus** on structural mechanics
- **Mission** is to provide CAE services and software in order to add value to our customers' CAE chain
- **20 years experience in FEA**
- **10 years experience in CAE software development**
- **Two software products** by our own:



- **Development partner** of major CAE software vendors

What is S-Life?

- S-Life is a FEM **post-processing software**
- that conducts a **static** and **fatigue strength assessment** according to German **FKM guideline**
- **based on the results of a FEA.**
- It computes the **static** and **cyclic utilization ratios**
- displays them as **3D-contour plot** on the component's surface
- and finally provides a **numerical report** with a **comprehensive output** of computation results for the critical node.



The Motivation

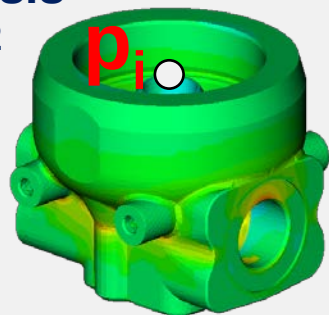


- The **FKM guideline** is the **de-facto standard** in German-speaking countries, when it comes to strength assessment of machine parts
- The guideline explicitly encourages the use of **FEM software** for stress analysis...
- ...but a **manual evaluation** of the computed stresses is **very time consuming and often erroneous**
- Competitive **multi-purpose fatigue solver** are **complex** in usage and only applicable by the trained specialist
- Particularly for **Abaqus** there is **no software on the market** that provides an easy-to-use and automated procedure for a strength assessment according to FKM guideline based on FEM results

The Concept

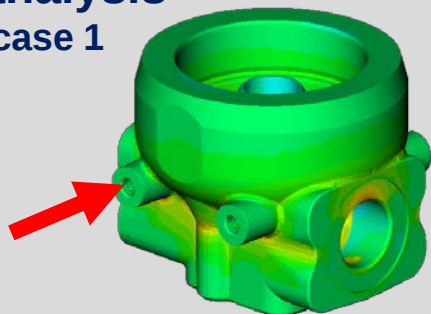
FE analysis

load case 2



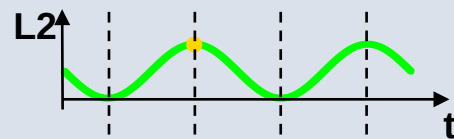
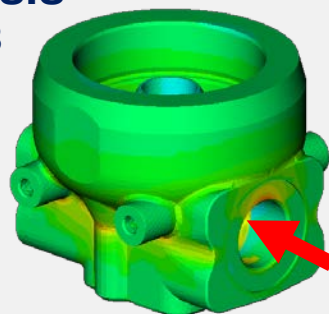
FE analysis

load case 1

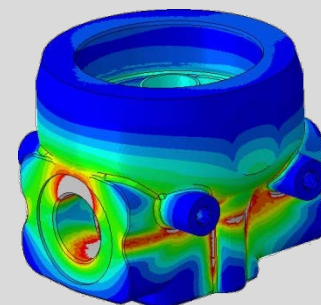
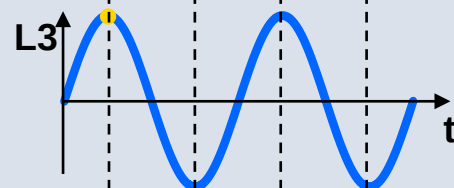
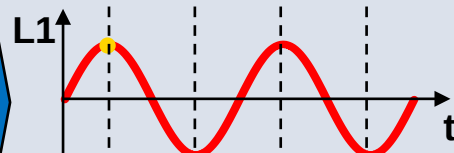


FE analysis

load case 3



Combinations

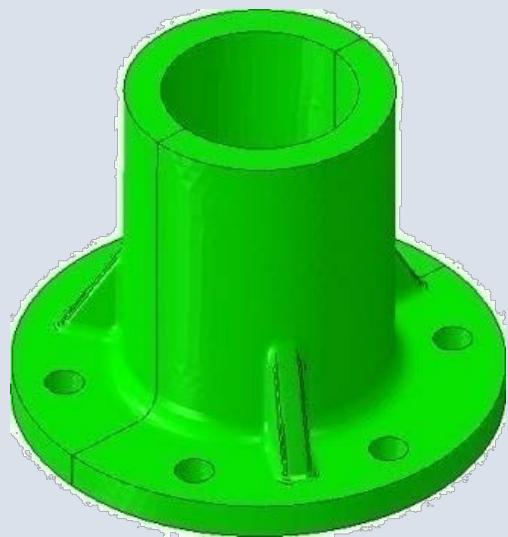


static and cyclic **utilization ratio** as contour plot for the **critical load case combination**

What can the user do?

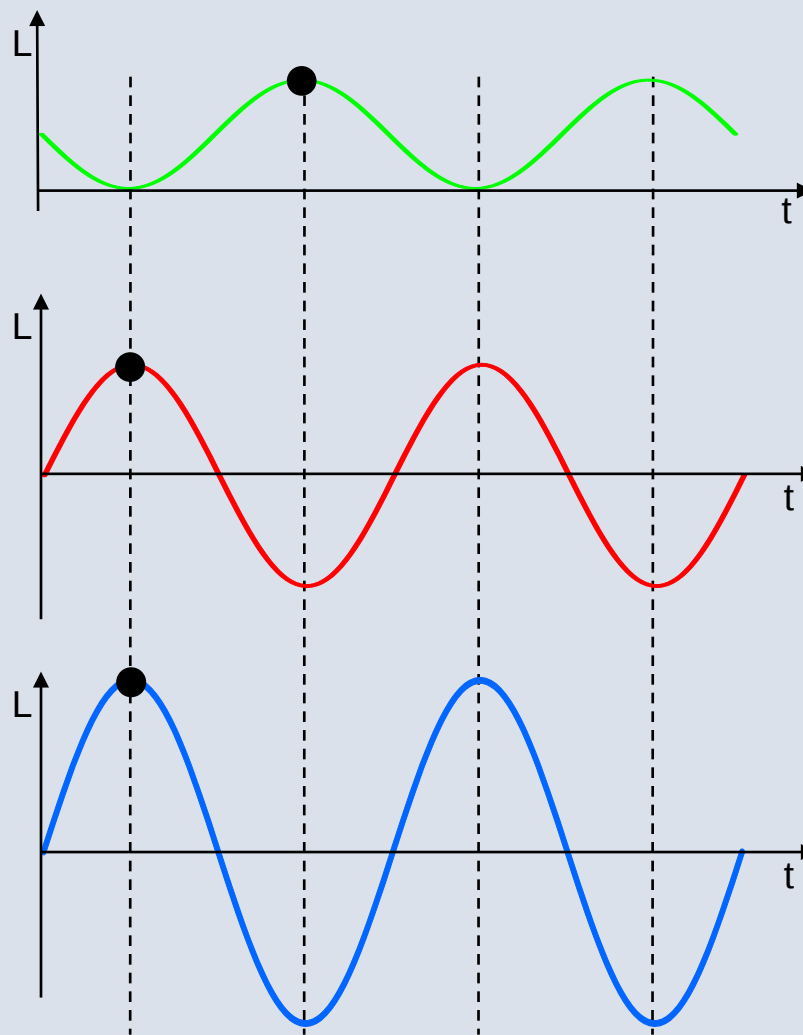
- FKM static assessment
- FKM fatigue assessment for a given load cycle number
- Determination of an allowed load cycle number for a given load case
- Optimization with regard to material selection

Case Study

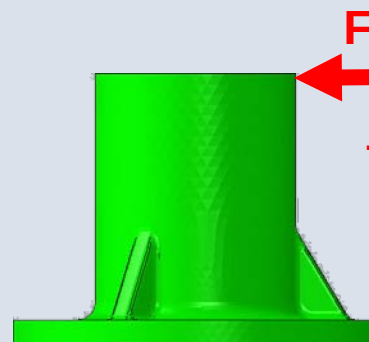


cast iron flange
EN-GJS-400-18
static and fatigue strength
for endurance limit

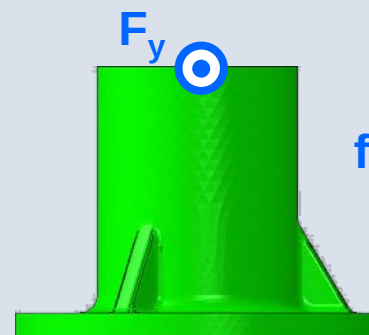
S-Life Demo



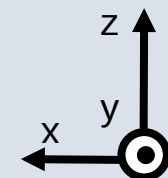
purely pulsating



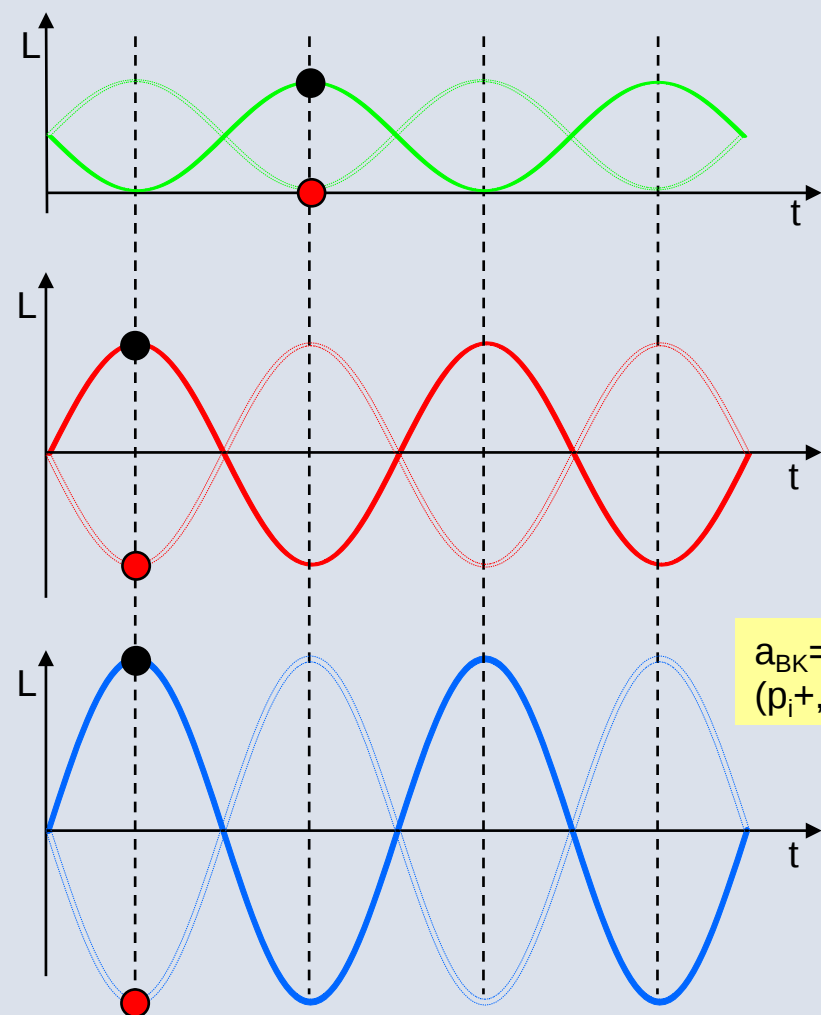
fully reversed



fully reversed



Case Study - Critical Load Case Combination



$a_{BK}=2,22$
(p_i^+ , F_x^+ , F_y^+)

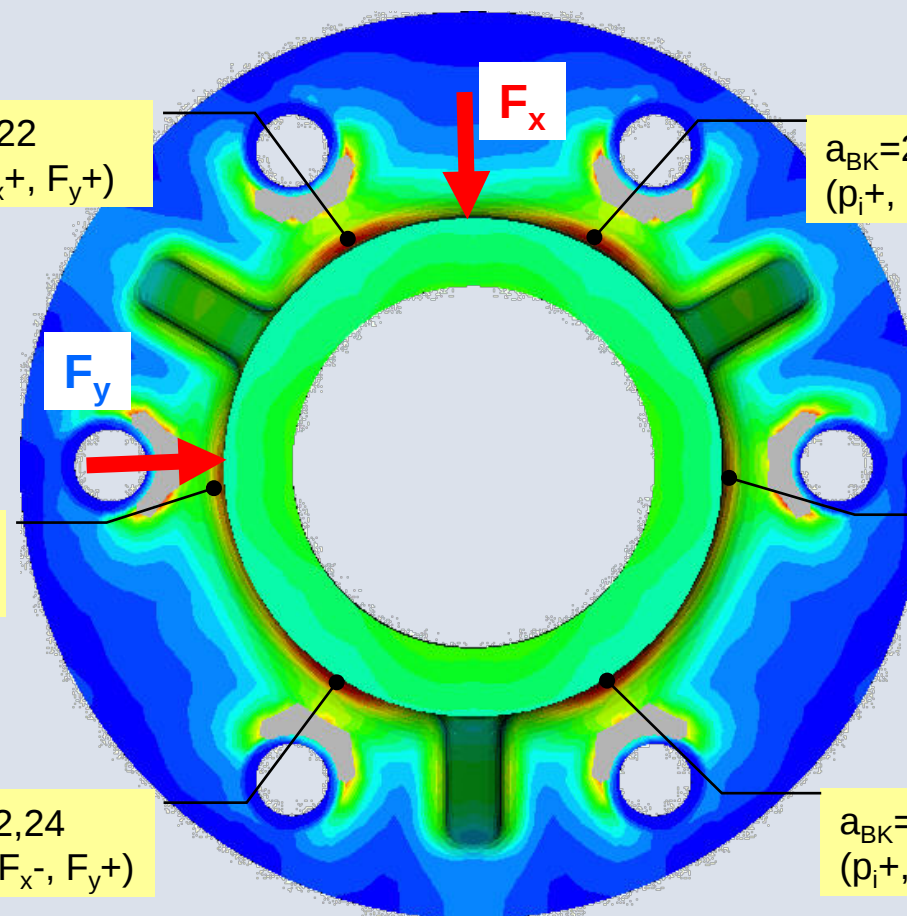
$a_{BK}=2,22$
(p_i^+ , F_x^+ , F_y^-)

$a_{BK}=1,87$
(p_i^+ , F_x^- , F_y^+)

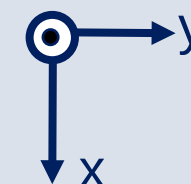
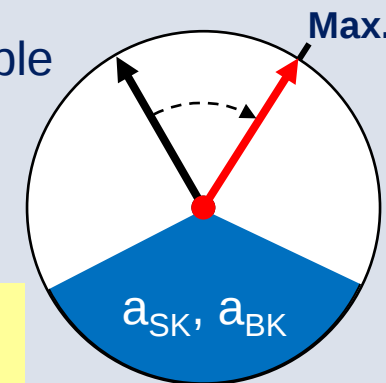
$a_{BK}=1,87$
(p_i^+ , F_x^- , F_y^-)

$a_{BK}=2,24$
(p_i^+ , F_x^- , F_y^+)

$a_{BK}=2,16$
(p_i^+ , F_x^- , F_y^-)

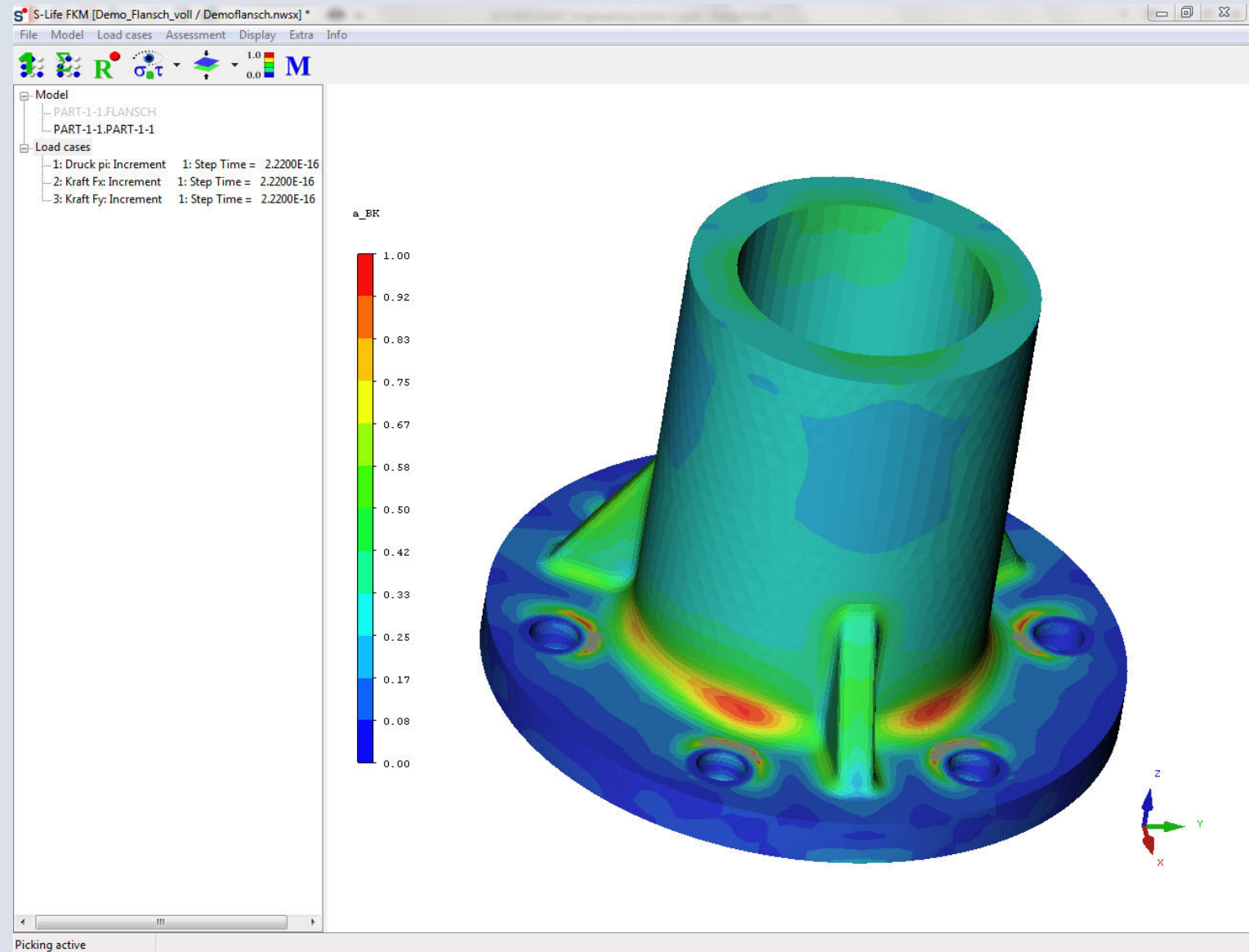


drag indicator principle



Case Study - Conclusion

- time consumption: < 7 min.
- static and fatigue assessment **satisfied**

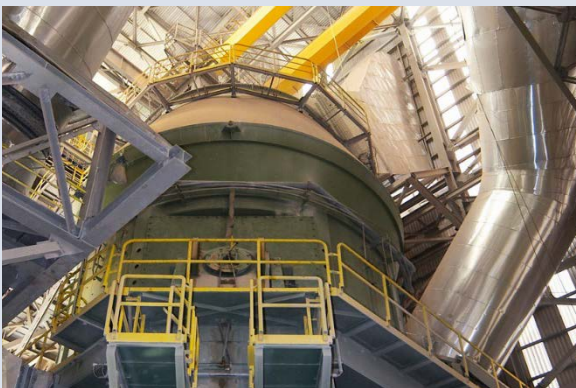


Key Features

Assessment	• according to “Analytical Strength Assessment of Components in Mechanical Engineering” in its 6th revised edition, Forschungskuratorium Maschinenbau, 2012 • for non-welded components • for FE solid and shell elements
Results	• static and cyclic utilization ratios as contour plots • comprehensive numerical report for individual node
Tools	• load case combinator for automatic determination of critical load case combination • material database with more than 1600 steel, cast iron and aluminum grades according to FKM guideline (user materials can be added)
GUI	• 3D-viewer • Windows GUI
Interfaces	• Abaqus (.odb), ANSYS (.rst), NASTRAN (.pch)
Licensing	• Floating as lease or paid up license

Users in Various Industries

**Rail • Defence • Energy- and Automatization • Process Engineering •
Mining and Off-Shore • Marine Engineering**



All licenses **floating**

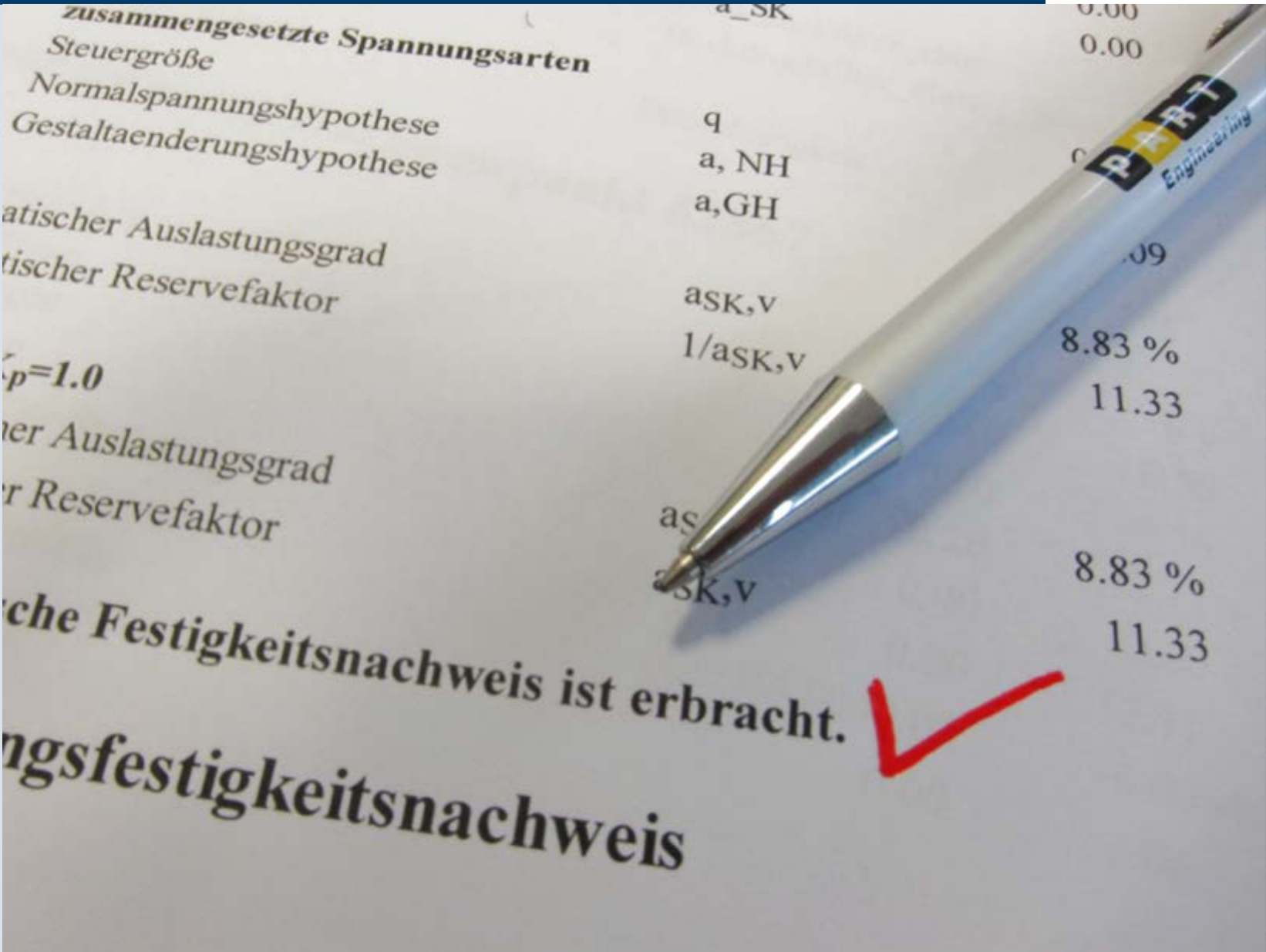
Annual Lease

includes maintenance & support

Paid-up 2.5 x lease

Annual maintenance & support
for paid-up license

20% of paid-up



The Benefits

- **Easy-to-use** even for the occasional non-expert user
- **Huge time-savings** compared to manual evaluation
- **Reliable results** according to a proven assessment scheme
- Basis for **unambiguous Go-NoGo - decisions**
- **Well documented** results for quality assurance purposes
- **Seamless integration** into CAE process chain

