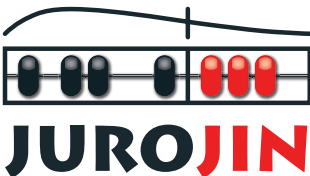


- 1 Main window
- 2 Probability density plot
- 3 Design of test schedules



JUROJIN – STATISTICS FOR FATIGUE TESTING AND RELIABILITY ANALYSIS

A key task in the development of mechanically stressed components is to hedge against failure during operation. Since the production process introduces significant scatter in the fatigue strength of components, proving their reliability requires tests with several specimens. Statistical methods are required to ensure that the results of these tests are interpreted correctly.

The statistical software package Jurojin developed at ITWM supports the design and analysis of fatigue tests. The algorithms and user interface are tailored to solve typical tasks in this context faster and more efficiently than general purpose statistics software. Jurojin is already used by several manufacturers of passenger and commercial vehicles.

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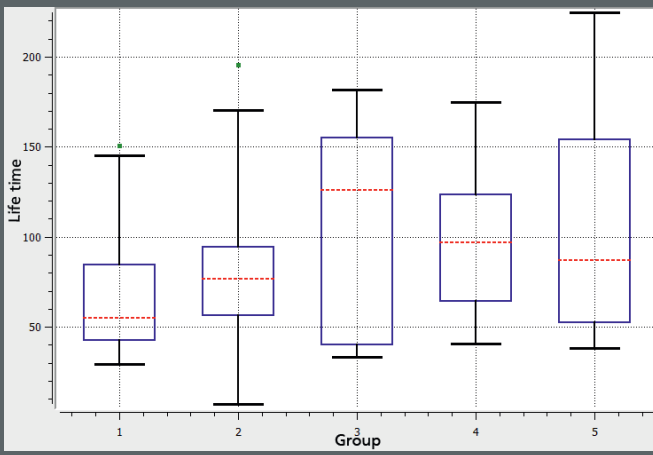
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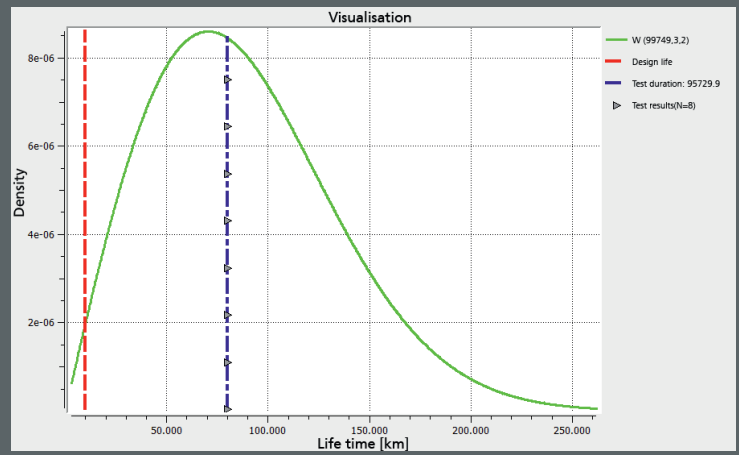
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Tasks that can be solved with Jurojin

- Design of test schedules – many short vs. fewer long tests?
- Extending tests to compensate for early failures
- Mathematically correct handling of censored data and late failures
- Derivation of failure probabilities relative to customer load distributions
- Comparison of manufacturers and versions
- Completion and extrapolation of early warranty claims to later time points



1



2

Design of fatigue test schedules

As component tests are lengthy and expensive, it is desirable to carry out only the necessary minimum. However, a component released on the basis of few tests is likely to be significantly overdesigned in terms of fatigue strength. Jurojin cannot make this problem disappear but helps to plan experiments that provide a maximum of information on a limited budget. Given a reliability target, one can answer the question if a few long or many short test are suited better.

Evaluation of fatigue tests

Fatigue test data are not easy to evaluate statistically. Small samples sizes and censored data (suspended tests only yield a lower bound for fatigue life) contain only limited information. Jurojin provides special algorithms to ensure the optimum utilization of the available data. In addition, the comparison of experimental results for similar components is supported. This helps to detect differences between manufacturers or variant designs.

Fatigue design versus variable customer loads

The automotive industry is continuously increasing their efforts to obtain a realistic assessment of customer loads and derive corresponding test loads. In Jurojin, failure probabilities can be calculated not only versus fixed load levels, but also with respect to an arbitrary, user-defined load distribution. The inverse problem of computing the minimum strength necessary to withstand such a distribution can also be solved.

Analysis of warranty data

Besides supporting pre-production testing of components, Jurojin also helps to analyze warranty data for components already in use. Such data is incomplete, because lifetimes are only known for reported defects, while little is known about intact units. Analyzing only reported defects would give an overly pessimistic estimate of reliability for the entire production run. To compensate for this effect, Jurojin can complete the sample virtually based on information about customer usage intensity. After fitting a life time distribution to the enhanced sample, more realistic forecasts of failure rates are possible for arbitrary time points in the future.

Special features of Jurojin

- Algorithms designed for censored data and small samples
- Different approaches for designing fatigue test schedules are supported – estimate either life time distributions or failure probabilities
- All common life time distributions are supported (Weibull, Lognormal, Normal)
- Visualization of test plans and data at your fingertips
- Interface design follows the process chain from planning to evaluation
- Configurability: fix parameters settings and limit control options to conduct standardized analyses and prevent accidental misuse. Software customizable on the basis of bilateral project work

System requirements

Jurojin runs on any standard Windows PC with minimal requirements for memory and processing power.

- 1 Comparing lots
- 2 Design life and test load