KRP Mechatec

KRP Mechatec GmbH

KRP Shock Engineering

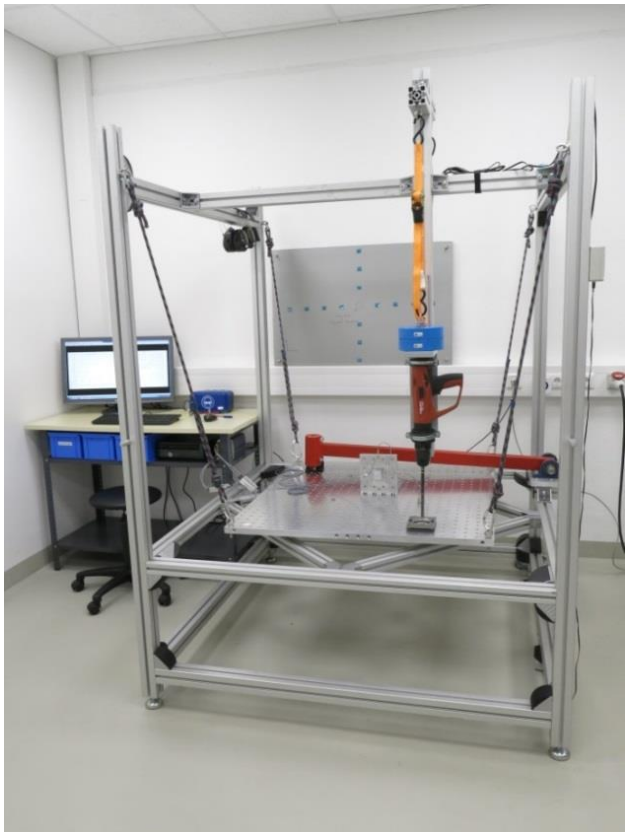
It is of crucial importance to design aerospace products taking into account the ability to withstand mechanical shocks. In this field, KRP offers a complete support from design to verification. Prediction, testing, and damping solutions are the key capabilities of KRP's portfolio regarding mechanical shock.

Prediction

A method used by KRP to predict the SRS is using **similarity-heritage extrapolation** at equipment interface considering that the old and new systems are of similar design according to the criteria exposed in ECSS-E-HB-32-25A. **Numerical analysis** is also used as additional tool to predict the shock.

Shock testing

Equipment shock testing



KRP Shock Test Facility with FSSA Mock up Sample (EnMAP)

In the KRP shock test facility, shocks are produced by mechanical impact on a resonant plate (e.g. **1000x1000x20 mm^3 Aluminium).** The mechanical impacts are performed in different possible ways to cover a wide range of shock profiles. E.g. dropping-mass using steel spheres or a hammer are mostly used to tune **far field shock**, a pyro actuated gun is used to achieve **near field shocks.** To achieve the required impact energy, tuning is done by mass dummies, providing repeatability of the shock.

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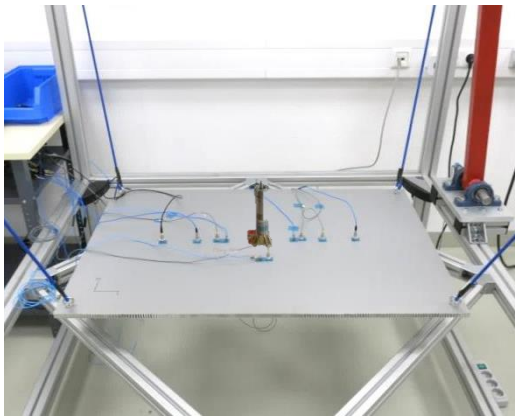
Mock up design and manufacturing

Prototypes are sometimes needed to verify the robustness of a component sensitive to shock loads already during the design phase prior to a qualification model (QM). Prototypes are also important to be able to tune the shock. KRP offers the capability to design and build such mock-up's.

Shock Measurements



KRP Shock Test Facility with LSRU Mechanism (NEA)

Shocks can originate from internal devices as release mechanisms, bolt cutters, pyro valves, frangi-bolts, etc. In this case, it is important to measure the shock path to make sure that the operation of such devices does not propagate critically along the structure and damages sensitive components. Sensitive units are e.g. electronic units, brittle materials, and optical systems.

Test monitoring

Piezoelectric shock accelerometers (with integrated electronics) from PCB (ICP) and B&K are used to achieve highly reliable responses. All the sensors have an integral fixing stud assuring a direct coupling with the surface. For adhesive mounting a minimal amount of X60 adhesive (ECSS-E-HB-32-25A preferred solution) is applied on a thin film. They have a high resonance frequency to cover up to 20 kHz.

Accelerometers available in house:

5 g for **micro vibrations**

50g - 500g for **vibration and modal analysis**

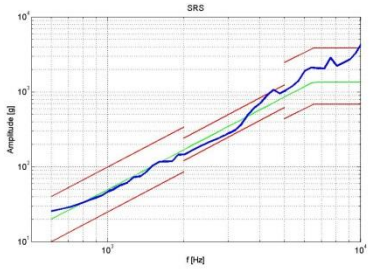
100 - 50000 g for **shock**

Acquisition system

High bandwidth data acquisition and anti-aliasing filter

Data analysis tools for shock

In situ calculation of **SRS/FFT** from **100 Hz to 100 kHz**



SRS example as calculated by KRP

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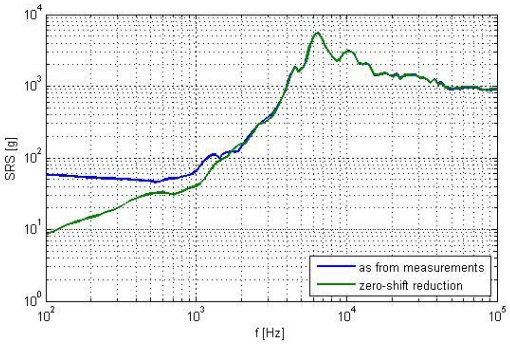
Shock data validation

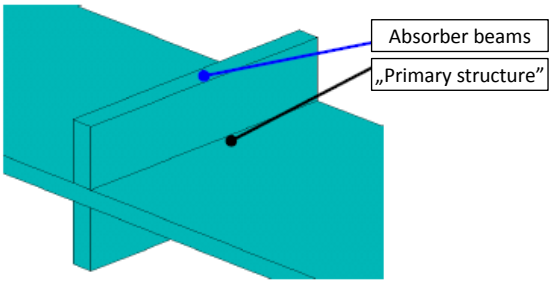
The initial slope of a shock specification physically can assume values between 6 and 12 dB/octave. For this reason is important to check the SRS slope around 100 kHz. It can happen that the time measures are affected by zero-shift errors. Those errors can be corrected. KRP provides velocity and **zero-shift correction** on real time data if required.



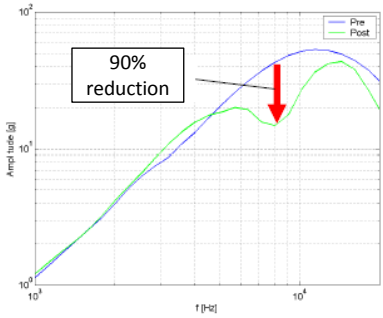
Example of zero-shift correction

Damping solutions

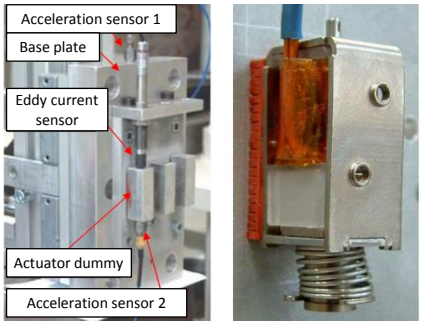
To reduce and isolate shock and vibration responses, KRP offers innovative design solutions for customers in the form of structurally integrated **damping elements**, such as profiled silicon dampers and/or integration of single mass oscillators.



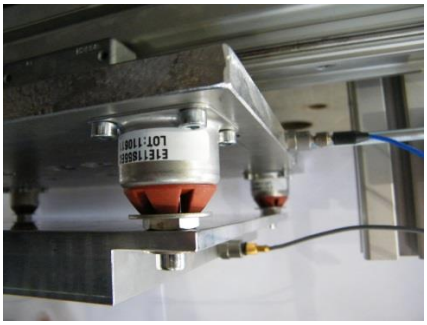
Example of structurally integrated damper (absorber on a beam)



Shock spectrum reduction due to absorber beams



Test set up with dummies actuators (left) and damped actuator (right)



Example of dampers for electronic unit

We look forward to hearing from you! Feel free to contact us at: +49 (0)89 3299 3107

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