

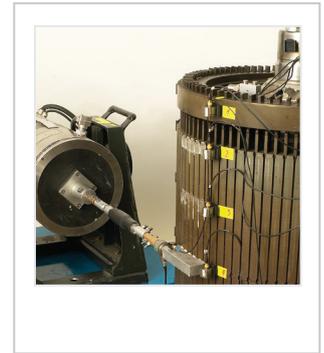


PAK STRUCTURAL ANALYSIS

Study the behavior of structures

By analyzing the structural behavior of single components, subsystems or eventually the complete system under specific operational conditions, Users are equipped to solve acoustical or vibrational challenges.

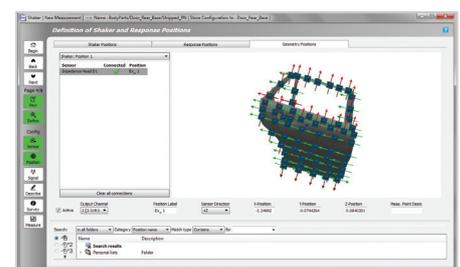
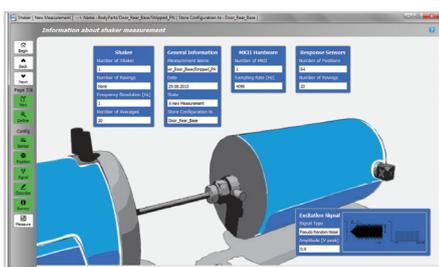
STRUCTURE AND EXCITATION: PAK SHAKER MEASUREMENT

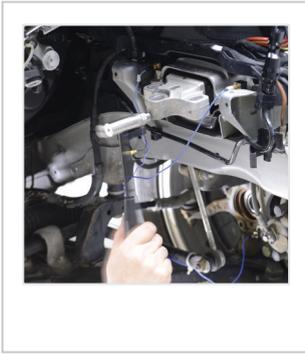


A shaker is often used for inducing large energies over a longer time period in sizeable or sensitive structures. Each structure has a specific resonant behavior which is triggered by the excitation. In the structure's eigenfrequencies a standing wave is established in its oscillating form. The self-oscillating behavior of any linear structure can be described by modal parameters determined through transfer functions. Our new application PAK Shaker Measurement, determines transfer functions between the accelerometers on the relevant response positions and the load cell of the shaker by outputting a defined excitation signal. Strongly damped structures in particular can be excited at high frequencies with a good signal-to-noise ratio. The operating structure conditions can be shown realistically by using several shakers and by biasing the structure.

AT A GLANCE:

- Output of specific excitation signals (noise, burst, chirp, sine sweep) for full signal control
- Amplitude shaping for determining the optimal excitation spectra and for interactively controlling the introduced energy on a high resonating structure depending on the vibration behavior for specific excitation frequencies' signals
- Biasing of structures during measurement to simulate more realistic operating conditions
- Online display of averaged data
- Workflow and position-oriented configuration of the measurement when using 2D and 3D sensors. All system transfer functions are shown in one measurement
- Interactive positioning on a geometric model
- Integrated measurement sequences for the complete identification of a structure's transfer functions
- Use cases:
 - Measurement with no biasing:
 - A fixed shaker and several fixed sensors
 - A fixed shaker and several roving sensors
 - A roving shaker and several fixed sensors
 - Several fixed shakers and several fixed sensors
 - Measurement with DC biasing
 - Measurement with an impedance head





STRUCTURE AND EXCITATION: PAK IMPACT MEASUREMENT

PAK impact measurement application enables efficient structural dynamic investigations due to its workflow orientation when testing of structures and measurement of FRFs for modal analysis.

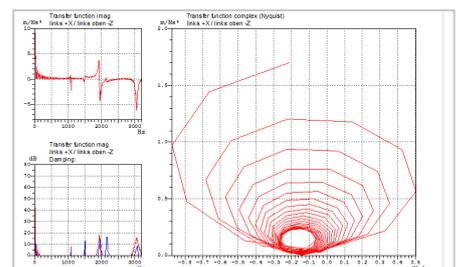
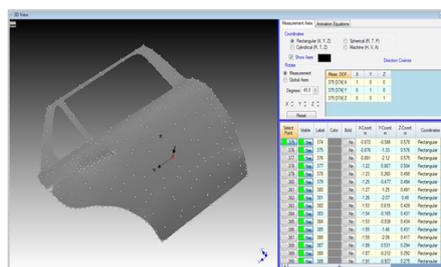
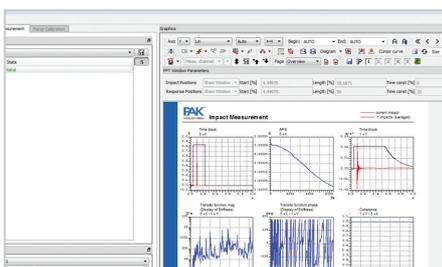
With an intuitive user interface as a compact control unit, all relevant steps of the impact measurement (including measurement settings, signal monitoring and measurement) are controlled from a single window. The integrated measuring modes “Moving hammer”, “Moving hammer and sensors”, “Mobility Measurement” and “Free Configuration” as well as a test-shock mode for hard to reach positions underline its workflow-oriented design.

Since the raw data of impact measurement is stored, the evaluation of data is completely flexible. For this, a pre-configured graphical display is available which includes a quick comparison of the current impacts with averaged impacts, an interactive editing of the FFT parameters (windowing) and a display of throughput data for signal checking. Furthermore complex Nyquist transfer functions and damping factors of single peaks can be interactively determined and displayed. In order to directly display the measurement quality, operational deflection shape analysis is optionally available online and offline. PAK Impact Measurement includes functions for the correction of hammer and sensor positions after the measurement and the enhancement of the graphic functions for displaying the inverse transfer functions. Users benefit from a more flexible way of working and an easier integration of transfer functions from impact measurements into TPS networks.

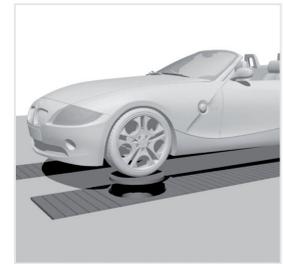
The setting of alarms for certain events or the definition of different colors for measuring states and controlling the measurement via keyboard shortcuts complement the integrated working of PAK's Impact Measurement. For later modal analysis an active interface to the software ME'scope is available.

AT A GLANCE:

- Real-time analysis
- Test-shock mode for hard to reach positions
- Display of complex Nyquist transfer functions
- Animation of the geometry as Operational Deflection Shape Analysis
- At each excitation point: Transfer function (amplitude and phase) can be displayed e.g. with coherence, per impact and averaged
- Storage of raw data of impact measurement
- Direct representation and storage of dynamic stiffness
- Barrier-free data export from PAK into ME'scope including object geometry (point, lines and surfaces)
- Optional Force Calibration to determine the calibration values for the impulse hammer



STRUCTURE AND EXCITATION: PAK HYDROPLUS® INTERFACE

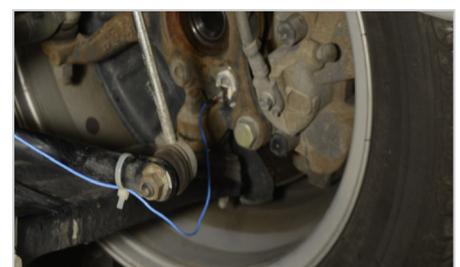
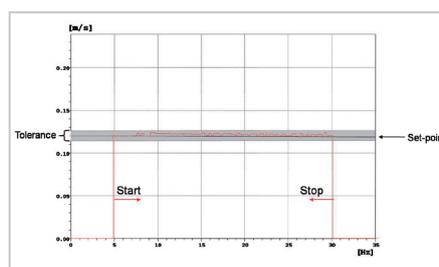
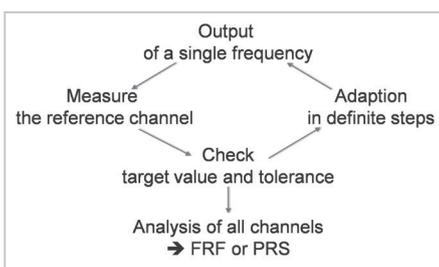


The software module Hydropuls® Interface is used for the excitation of a multi-stamp Hydropuls® facility with up to four output channels. The output signal is thereby set to a fixed, measured amplitude value in defined steps. A multiple output is supported where all four channels can be displayed with the same frequency and amplitude, but with a different phase position.

The amplitude adaption is carried out on the measurement value of an acceleration channel. From the acceleration, velocity or distance is derived. The output signal is adjusted at each sine curve in such a way that the user-defined value is obtained.

AT A GLANCE:

- Interfacing of a Hydropuls® test bench for vehicles
- Signal output over PAK Function Generator
- Excitation by means of a stepped sine with constant amplitude
- Conversion of base measurement quantity acceleration to velocity and distance
- Maximum number of adaption steps adjustable
- Single line analysis by means of Kalman-filtering
- Multi-channel output with a user-defined phase shift (180°) between the stamp positions front/back, left/right, crossed





STRUCTURE AND ANIMATION: PAK OPERATIONAL DEFLECTION SHAPE

The Operational Deflection Shape Analysis illustrates the movement patterns of a structure during real operation. Oscillations can be visualized with animations. The test candidate's movements are displayed with lower speeds and higher amplitudes when compared to the original in order to make the animations visible. This is achieved by initially generating a three dimensional structural model of the test candidate in the software module and linking its geometric points to the measuring points. The animation reflects the form of the operational deflection shape with regards to the desired time frames or frequencies of the measurements under its real operation.

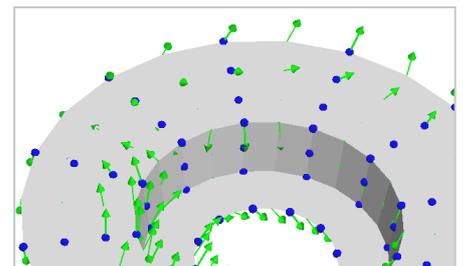
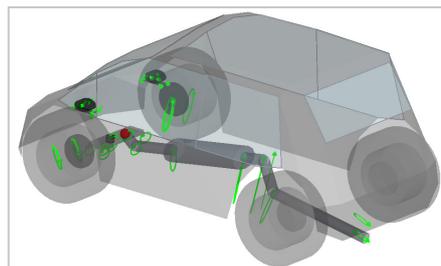
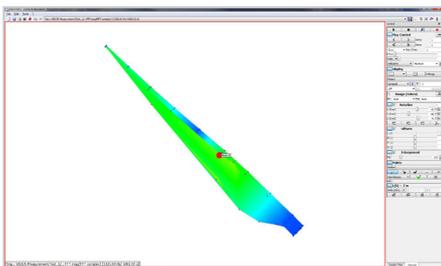
The Operational Deflection Shape software module requires throughput data or complex spectra with amplitude and phase. Vibration measurement variables - acceleration, velocity and displacement - can be shown in translational and rotational degrees of freedom. The Operational Deflection Shape module is also capable of processing various other measurement values, such as force or torque.

Typical applications include animation of the chassis and the analysis or load change reactions of engine and drive train. Animated models can be created for all oscillations including air filters, exhaust system, engine power units, generators or servo pumps.

Special applications are also supported such as belt drives. It is possible to view the translational oscillation of belts, tensile forces within the belt, the resultant forces exerted on the belt discs as well as rotational vibration. Thus the interaction of complex mechanism effects can be visualized, as would, for example proceed shortly before the belt slides through.

AT A GLANCE:

- Animation of the following data types: throughput, FFT, CPS, single order or complex order spectrum
- Time and frequency domain visualization
- Element Editor for easily creating points, lines, polygons or geometric bodies
- AVI recorder
- Visualization of rotational vibrations in the form of vector diagrams
- Synchronization of different geometries



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