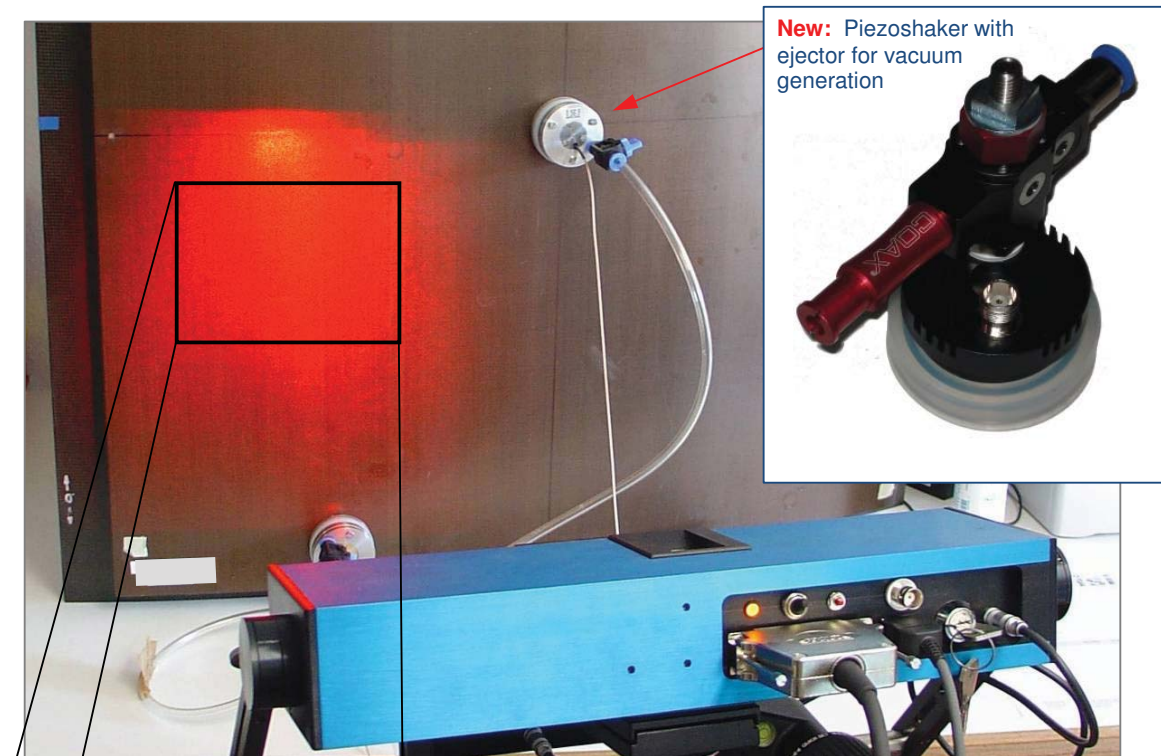


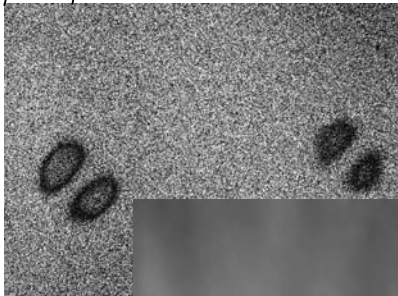
Vibrography / Piezoshaker Systems

- ✓ for high frequency vibration excitation and analysis and
- ✓ for non destructive testing (NDT) – see also separate flyers

The piezoshaker systems are designed for handy use in non destructive testing and vibration analysis. They are tested to beyond 50kHz (100kHz). The modules can be calibrated for pre-determined excitation forces. Vacuum cups are available for quick and easy fixing on the object.



New: Piezoshaker with ejector for vacuum generation

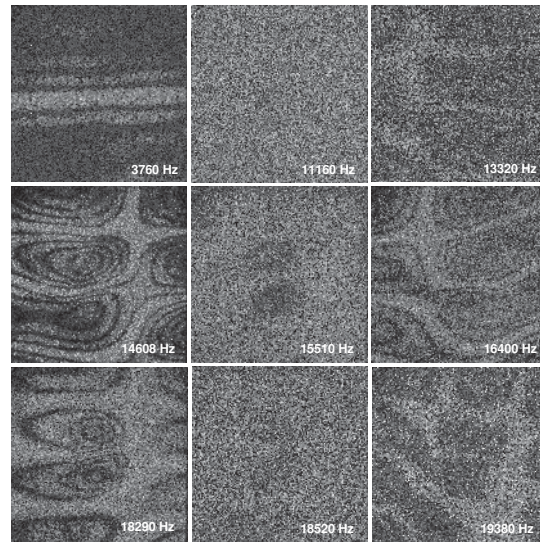
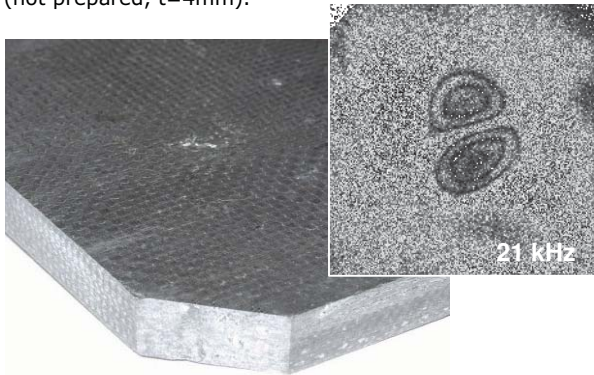


[Principle] Dynamic excitation of structures in combination with Shearography is a special technique for non destructive testing developed by **isi-sys**. The small portable piezo shaker permits local excitation of defects such as cracks, de-laminations and dis-bonds. Vibrating in their local mode shapes the system visualises the defects during a frequency sweep within seconds. The images (left) show two prepared dis-bond within a carbon fibre composite structure.

The excitation frequencies (sweeps) are software or manual controlled. For mobile applications portable rack systems include power amplifier, function generation and vacuum pumps for easy piezo mounting with vacuum cups are available.

[Sweep Application Example]

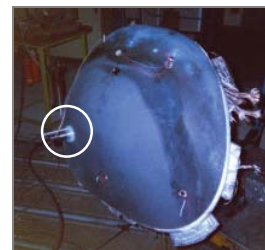
Dynamic excitation in combination with Shearography applied on C-Si-C composite plate (t=10mm): Selected online deformation measurements during frequency sweep of a location with a manufacture disbond in the middle (not prepared, t=4mm).



[Piezoshaker]

Piezoshakers are available for different frequency ranges (up to 100kHz and above). The latest standard design (PS-X03-series) is shown right with vacuum cup for easy fixing on the object surfaces and shuttle valve (left) or with integrated ejectors for vacuum generation by pressurized air (right). Various adapter mounts are possible e. g. for small object mounting such as electronic components.

isi-sys has a wide experience based practical applications of dynamic excitation for non destructive testing. On this background the piezoshakers design has been continuously developed over the past 10 years. Optional the modules can also be calibrated for pre-determined excitation forces by the user.



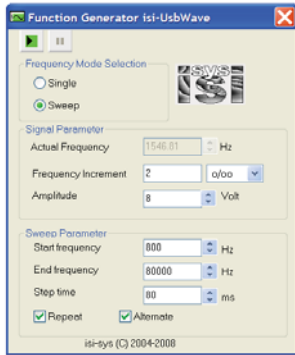
[Amplifier]

Piezoshakers require high voltage at high frequencies especially for non destructive testing. The **dual channel** bipolar amplifier HVA-B100 is specially developed for these applications. The device includes a small vacuum pump with power control, which allows to adjust **pressing force** of the piezoshaker vacuum adapter. The simultaneous attachment of two or more piezoshakers permits a more uniformly distribution of excitation power over the object surface and correspondingly the observation area.



[Function generation]

The excitation frequencies are generated by function generators and controlled via a isi-software modules e. g. for automated sweeping (included to isi-Studio or as stand alone modules or DLL). The function generator are available as built in or external USB wave generator devices, which permit phase-continuous frequency hopping (20mHz frequency resolution) up to 12 MHz sine wave generation (square 5MHz, triangle 1MHz). The amplitude range and offset output is +/-10V.

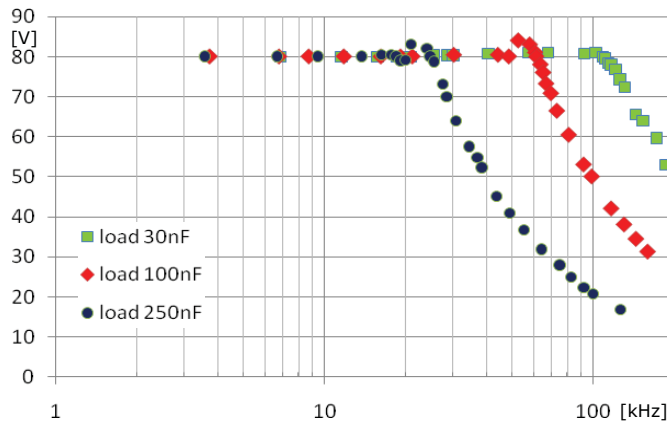


isi-software also supports Agilent function generator devices 33120A or 33220A as well as National Instruments PCI-boards function generator devices such as NI5401 or later models. Ask for currently supported device and compatibility. An optional synchronisation module permit triggering stroboscopic devices such as isi-videostroboscopes, flash lights or stroboscopic Shearography / ESPI.

[Power and transfer function]

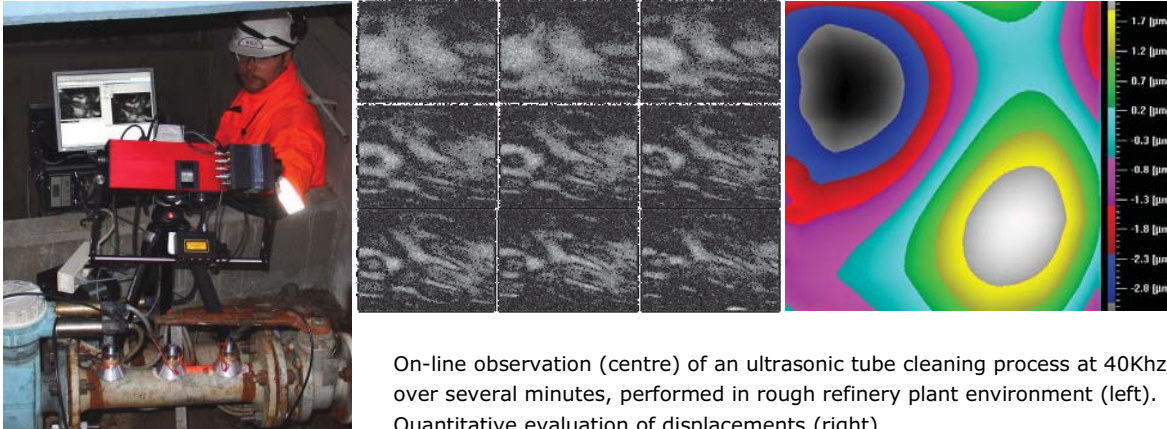
The excitation power is controlled by the voltage/current output and frequency of the function generator. Maximum power, force and acceleration are functions of frequency and depend on transfer function of amplifier as well as on the piezo-crystal material and number of layers per stack. Characteristic values are capacity and stroke.

However the excitation power, which is effectively transferred into the structure in the practical application, also depends on parameters such as roughness of object surface and contact pressing force as well as the stiffness and damping properties of the object- and piezo-material.



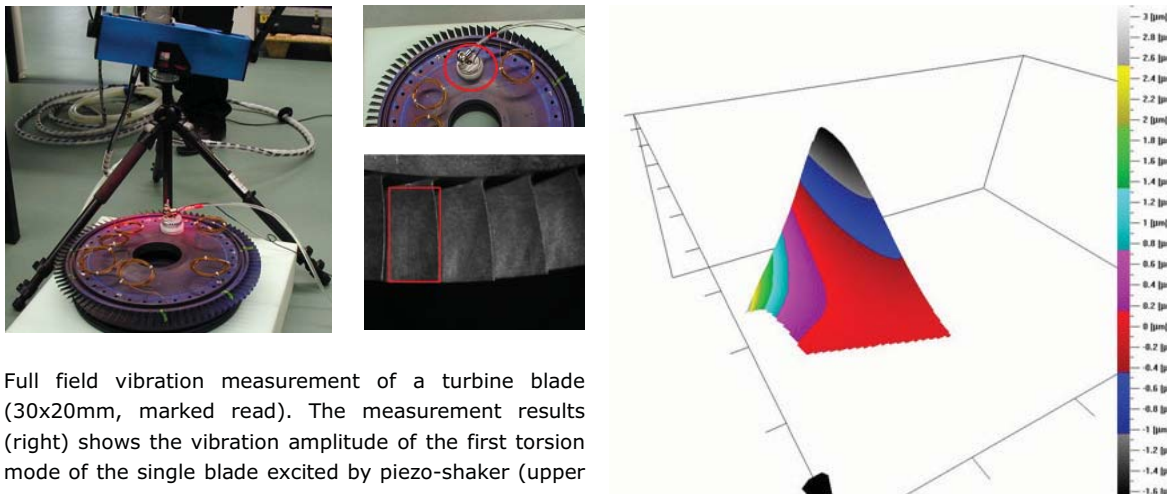
The selection of piezoshaker depends on the application. For NDT two shaker types covering different frequency ranges have been established: **PS-X03-6/500** is used up to approx. 30 kHz (<250nF) with 2,4µm stroke at 100Vpp and **PS-X03-6/1000** up to 100kHz (<30nF) with 1,2µm stroke at 100Vpp.

[Example: Vibration observation of ultrasonic tube cleaning process]



On-line observation (centre) of an ultrasonic tube cleaning process at 40KHz over several minutes, performed in rough refinery plant environment (left). Quantitative evaluation of displacements (right).

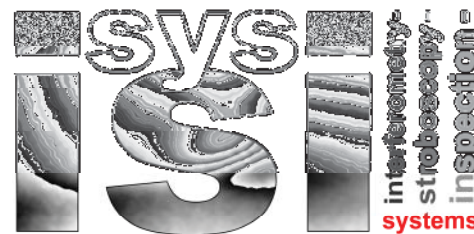
[Example: Vibration measurement on turbine blade]



Full field vibration measurement of a turbine blade (30x20mm, marked read). The measurement results (right) shows the vibration amplitude of the first torsion mode of the single blade excited by piezo-shaker (upper image, red circle) at approx. 7kHz.

[Features and Advantages]

- Full field, non contact measurement
- No need for optical table.
- Applicable with electromagnetic shakers
- On-line observation of periodic vibrations
- No frequency limit for time average modes
- Stroboscopic modes up to 50kHz (100 kHz)
- Image diagonals: from 10mm to above 10m
- Spatial resolutions (standard) 2452x2056 Pixel
- Out-of plane sensitivity below 20nm
- Automatic frequency generation (sweeping)
- Laserclass 1 or 2M (no safety requirements)



Our resolution is the wavelength of light