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# **Abstract Book**

## **1<sup>st</sup> International Symposium on Multi-Scale Experimental Mechanics (ISMEM-1)**

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# Scanning laser Doppler vibrometry

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**Marie Brøns**, MSc student. Current theoretical and experimental MSc thesis work on modified Timoshenko beam theories. User of the scanning laser facility at MEK, DTU.



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## Abstract

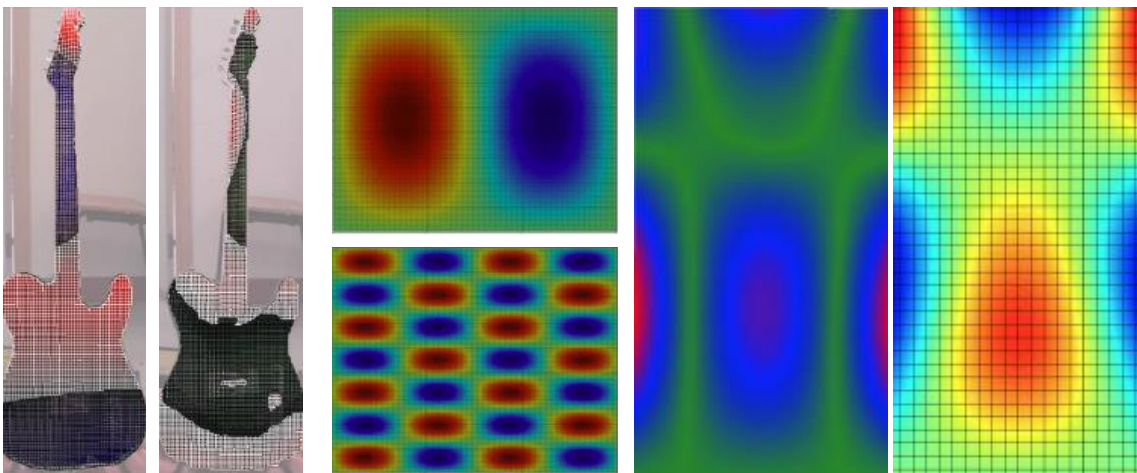
With a *Scanning Laser Doppler Vibrometer* (SLDV) a vibrating surface is automatically scanned over predefined grid points, and data processed for displaying vibration properties like mode shapes, natural frequencies, damping ratios, and operational deflection shapes. Our SLDV – a PSV-500H from Polytec Inc. – was acquired and put to operation in October 2014, paid by a sub-donation of DKK 1,5 mill. of the total VILLUM CASMaT grant. Opening possibilities of measuring complicated vibration shapes of almost any object – contactless, mostly automatically, and with only a single transducer – this costly equipment had been top priority on our wish list for many years.

The equipment is installed in suitably protected environments in a lockable small room in the larger lab.-building 414/041 at DTU Lyngby Campus, just next to our Brüel & Kjær PULSE open space lab. for more traditional vibration analysis (using accelerometers or other single-point transducers). In the talk we provide a brief account of what can be done with the equipment, and some examples of recent and planned usage. Some main features of the equipment are listed below.

- Measures *velocity*, 1D/out-of-plane (optionally 3D), non-contact, full-field, stationary and transient
- Range: Velocity 0.001-10 m/s; Deformation > 0.1 mm; Frequency 0-100 kHz; Distance 0.12-100 m
- Measurement objects: > 1 mm (smaller with an optional microscope front); Generally 3D / curved, with a diffusively reflecting surface (i.e. *not* glossy black or like a window or mirror)
- 3D object geometry definition by (ordinary) distance laser sensor
- Easy scan grid definition / re-definition, typically takes a few seconds
- Spatial scan rate up to 50 points/s; full scans take from seconds to hours, typically unsupervised
- Built-in signal generator for driving object exciters (shaker, piezo discs, loudspeaker,..) using, e.g., swept sine, burst/stationary random, or impulse signals
- Easy export to common commercial modal analysis program (we use ME'Scope)
- Well suited for standard shaker testing; handles input e.g. from force transducers or other reference signals to calculate frequency response and coherence functions
- Available for use by CASMaT associates that already holds some expertise in standard experimental vibration testing. A lab. technician will get a new user started by demoing a simple standard measurement. Beyond that the user will generally need to bring in or acquire his/her own expertise.



The PSV-500H scanning laser vibrometer [Polytex Inc.], and an example test object [Joensen 2015]



Guitar body & neck mode shapes @193/1038 Hz [Joensen 2015]

Thin plate mode shapes @608/10114 Hz. [Joensen 2015]

Clamped plate mode shapes, measured (left) and theoretically predicted (right) [Støme 2016]