System and Process Assessment Research Laboratory
SPAR Lab
Missouri S&T

REMOTE SENSING VIBROMETER RSV-150

Description of Equipment

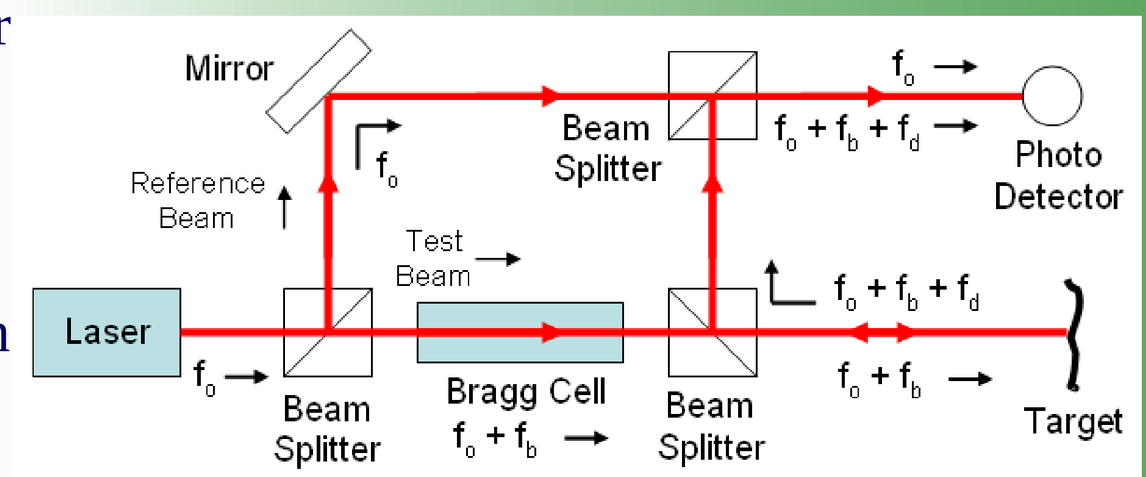
- **A noncontact/point-and-shoot monitoring technique over a long measurement distance during dynamic tests.**
  - The advanced laser Doppler interferometer technology that can save significant time by eliminating contact sensor installations.
- **Measurement range**:
  - Frequency: 0.1~10,000 kHz,
  - Operation distance: 5~100 m,
  - Voltage range: -10~10 V,
  - Vibration velocity: 0.000001~10000 mm/s,
  - Vibration displacement: 0.000001~1000 m.

Key Features

- Precise target on remote objects due to an in-line video camera on a steady tripod system.
- User friendly design in field applications with a 2 channel data acquisition for a laptop with video-in for on-site analysis and documentation of the test results.
- Up to 24 m/s velocity measurement with up to 2 MHz frequency.
- No need to cleanse surfaces prior to and during measurement, which is suitable for rapid testing.
- Independent of temperature effect, which is applicable to furnace and steam pipe monitoring.
- Long stand-off distance, which is suitable for difficult-to-access or hazardous areas such as high-voltage electrical power supply components and systems.
- Ambient vibration compensation with a reference channel of a compensation sensor.

Principles of Operation

- A vibrometer is a two beam laser interferometer
- A laser beam of frequency f_0 is divided into a reference beam and a test beam with a beamsplitter. The test beam passes through the Bragg cell that adds a frequency shift f_b, and is then directed to a vibrating target whose motion adds a Doppler frequency shift f_d that is proportional to the velocity of the target.
- Light scatters from the target in all directions. Some portion of it is collected by the vibrometer and reflected by the beamsplitter to the photodetector. The scattered light with a frequency of $f_0+f_b+f_d$ is combined with the reference beam at the photodetector.
- The initial frequency of the laser f_0 (> 100 THz) is significantly higher than the two frequency shifts. Thus, the photodetector responds to the beat frequency between the two beams, f_b+f_d (tens of MHz).
- The output at the photodetector is a standard frequency modulated signal with the carrier frequency f_b and the modulation frequency f_d. The signal can be demodulated to derive the velocity time history of the vibrating target.



Applications

- Elevated bridges, high-rise buildings, towers, and wind turbines.
- High-temperature structures such as furnaces, steam pipes, nuclear reactors, and high temperature environment.
- High-voltage structures, such as transmission cables.

Contact: Genda Chen, Ph.D., P.E., SPAR Lab Director, Phone: (573) 341-4462, Email: gchen@mst.edu