ACOUSTIC MATERIAL MEASUREMENT USING SCANNING LASER DOPPLER VIBROMETER

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ABSTRACT

Architectural acoustic design requires knowledge of the behavior of sound sources and of the interaction of sounds with surfaces. Traditionally, measurement techniques utilizing microphones and accelerometers have been used to obtain quantitative values for sound pressure and vibration, respectively. In some situations, microphones and accelerometers drastically interfere with the measurement object. The limitations of these sensors motivates the investigation of optical techniques for certain acoustic and vibro-acoustic measurement task. The well-established two-microphone technique for determining the acoustic absorption of a material in an impedance tube has physical limitations which hinder the measurement of this quantity at high frequencies. Tube geometry, microphone spacing, and perturbation of the sound field by measurement instruments make the determination of normal incidence absorption coefficients above 10 kHz difficult if not impossible using microphones and the traditional impedance tube methods. In a recent work, an extended impedance tube technique utilizing a Scanning Laser Doppler Vibrometer (SLDV) was presented [Vanlanduit *et al.*, J. Acoust. Soc. Am. **3** 1 2005]. A method using a single point Laser Doppler Vibrometer (LDV) was used to study the limitations and merits of acousto-optic sensing in impedance tubes in this study. Foams of various thicknesses are measured using the transfer function method in a transparent impedance tube. Results are presented which convey the potential usage of these acousto-optic techniques in the measurement of acoustic reflection properties of materials up 20 kHz and beyond.