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In measurements of spatial distribution of surface deformation in studies of flow induced vibration[1] CAO ZHANG, RINALDO MIORINI, JOSEPH KATZ, Johns Hopkins University — In studies involving flow-induced vibrations, it is necessary to measure the spatial distribution of surface motion simultaneously with the unsteady flow causing it. To achieve this goal, we developed a method for measuring the time resolved spatial distribution of surface deformation. Different approaches can be used for transparent and opaque surfaces. For a transparent wall, e.g. a compliant PDMS coating, high speed, digital Mach-Zehnder Interferometry maps the time-resolved surface shape. Calibrations demonstrate that a sub-micron resolution can be readily achieved, and that the sensitivity of the method can be adjusted to the expected range of surface deformations by varying the refractive index of the fluid. This technique is integrated with a time-resolved tomographic PIV system by bleeding/sampling 0.1% of the thick laser sheet energy illuminating the wall, and does not require an additional light source. Combined, it allows simultaneous flow and deformation measurements. For opaque surface, time resolved electronic speckle pattern interferometry (ESPI) could be used to measure the surface deformation by interfering light reflected from the surface with an external reference beam. Calibrations demonstrate that this method also achieves sub micron resolution.

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