

**The Autodyne Laser Vibrometer.** Thomas Karr, DARPA/STO (USA).

## **ABSTRACT**

The autodyne laser vibrometer is a self-referencing coherent sensor that can measure the optical phase shift of a scattered laser beam induced by motion of the scattering surface. The micro-Doppler vibration of the target surface can be extracted from extracted from time series of these phase measurements. The name “autodyne” refers to its architecture, which is similar to the Sagnac interferometer. It is self-referencing, so it requires no stable optical local oscillator. Consequently it is well suited to operation in the field, where an optical LO is sensitive to many sources of noise. At long range from an unenhanced target, the autodyne vibrometer is signal-starved, so it must be analyzed as a quantum-limited sensor. The theory of this vibrometer is presented, and its measurement noise equivalent vibration velocity (NEVV) is derived as a function of its design parameters.