Mirror reflectometer based on optical cavity decay time

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Abstract

Described is a reflectometer capable of making reflectivity measurements of low-loss highly reflecting mirror coatings and transmission measurements of low-loss antireflection coatings. The technique directly measures the intensity decay time of an optical cavity comprised of low-loss elements. We develop the theoretical framework for the device and discuss in what conditions and to what extent the decay time represents a true measure of mirror reflectivity. Current apparatus provides a decay time resolution of 10 nsec and has demonstrated a cavity total loss resolution of 5 ppm.

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Distributed vibration sensors provide a very effective way in structural health monitoring (SHM) to detect potential critical damages of civil structures and industrial machines. 1984. Mirror Reflectometer Based On Optical Cavity Decay Time. Applied Optics 23: 1238-1245. Bahnev, b., L. van der snepen, a. e. wiskerke, f. ariese, C. gooijer, and w. ubachs. This device is based on a semiconductor laser source, which is efficiently coupled into the optical cavity through a mode matching telescope. Before the cavity, a Faraday isolator prevents feedback from the reflective elements into the laser, ensuring the wavelength stability of the system. Also before the cavity is an acousto-optic modulator (AOM), which allows the laser to be rapidly switched off when the cavity is fully excited.