External Cavity Diode Laser Applied in Speckle Interferometry

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In this work we present a novel method to generate contour fringes through a synthetic wavelength speckle interferometry using a single external cavity diode laser. The main operation principle of an ECDL aim to use a small and controlled feedback - with a diffraction grating in our case - to select the wavelength emission or a double emission from a diode laser. This technique is an efficient way to improve the diode laser properties like its source stability and narrow the emission keeping a fair operation.

A proper alignment of the external cavity generates a dual emission of the laser. The illumination of an object with two different wavelengths with a DSPI interferometer generates speckled images covered with interference fringes according to the wavefront shape. Since the contour interval of the interference pattern corresponds to $\lambda_S/2$, changes in a few nanometers of the laser emission correspond to an extended large range of possible synthetic wavelengths ranging from tens of micrometers to some millimeters. The likelihood of changing the contour interval makes this interferometer a useful tool enabling to set the desirable interference patterns for many specific applications. The results show the extended range of this interferometer with many interference pattern of a lens with synthetic wavelengths ranging from 50μm to 8mm.