INTERFERO-DIFRACTIVE LINEAR OPTICAL ENCODER WITH NANOMETRIC RESOLUTION

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In this work we develop a device for determining the linear displacement between a linear grating and a scanning head. Then, the standard technique used for generating the optical signals is double grating imaging: Moiré, Talbot or Generalized grating imaging configurations. The accuracy and resolution of optical encoders improves when the period of the diffraction gratings decreases. When the period of the grating is smaller than 10 um, double grating configuration is not valid since the mechanical tolerances are too restrictive. In our case, we use a diffraction grating of 4 um and then the Talbot distance is about 30 um for visible light.

As a consequence, we have used an interfero-diffractive configuration where one diffraction grating is used. The light coming from a laser-diode impinges the diffraction grating. The diffracted orders are redirected using a retro-reflector and then they interfere. As a consequence, an optical sinusoidal signal is obtained. This optical signal varies with the relative linear displacement between the scanning head and the diffraction grating. The displacement of the optical signal is 4 times the real displacement. Nanometric resolution is obtained using additional interpolation electronics (+50). An analysis of the technique and an experimental verification are performed.

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