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论文

基于古斯-汉欣位移效应的波长传感研究

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摘要:

利用双面金属包覆波导在导模共振激发时对古斯-汉欣位移具有极大的增强效应来实现激光波长微小变化的监测.双面金属包覆波导由上层金膜、导波层和下层金膜组成.当导波层厚度为亚毫米尺度时,应用自由空间耦合技术使入射的激光以小角度入射,在满足相位匹配的条件下激发超高阶导模.理论研究表明,当波导的辐射损耗等于本征损耗时,反射光的侧向位移可达到数百微米,并且此时激发的超高阶导模对波长具有极强的色散能力.通过测量反射光的侧向位移可实现对激光波长变化的实时探测,且具有很高的灵敏度.同时,实验中探测信号只与光束位置相关,可有效避免因光源输出光强的波动带来的干扰.实验测量结果表明对激光波长在859nm附近的分辨率可达到0.2 pm.

关键词: 双面金属包覆波导 超高阶导模 古斯-汉欣位移 波长传感

Wavelength Sensing Based on the Goos-H nchen Effect

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Abstract:

The Goos-H nchen effect,which is enhanced by the resonance of the guided mode in a symmetrical metal-cladding waveguide with submillimeter scale,is used to detect the slight variation of wavelength.The symmetrical metal-cladding waveguide consists of a guiding layer and two metal-cladding layers.When the laser beam incidents on the surface of the coupling prism with a small incident angle,the ultrahigh-order mode will be excited under the phase-matching condition,which exhibits a strong dispersion ability of the wavelength.Theoretical analysis indicates that the GH lateral shift is closely related to the intrinsic and radiative dampings of the waveguide.As the two dampings of SMCW approach to the best matching condition,the GH shift will exhibit a great enhancement and the lateral GH shift may reach several hundreds of microns.Since the detecting signal is proportional to the displacement of the light beam,the measurement will not be affected by the fluctuation of the light intensity.A wavelength resolution of 0.2 pm near the wavelength of 859 nm is demonstrated in experiment.

Keywords: Symmetrical metal-cladding waveguide Ultrahigh-order mode Goos-H nchen effect Wavelength sensing

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