论文

亚波长金属波导的光传播和干涉特性研究

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摘要：

利用时域有限差分方法研究了亚波长金属波导TE波的传播特性和基于异常透射现象的干涉特性.对各种参量对驻波特性的影响及两列波导间的耦合特性进行了分析.研究发现,TE波在波导中传播时存在截止宽度,如果波导宽度小于截止宽度,TE波在波导中不能传播;如果波导宽度大于截止宽度,TE波的传播距离将随波导宽度变大而突然增加.当波导宽度达到或大于半波长时,TE波可以在波导中正常传播.金属波导的截止宽度与金属的吸收系数成正比.此外,由于光在亚波长金属波导透射时的异常透射现象,在亚波长金属波导中产生了TE波的干涉现象,能形成驻波.

关键词： 亚波长金属波导 传播特性 干涉特性 时域有限差分法

Optical Propagation and Interference in the Sub-wavelength Metallic Waveguide

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Abstract:

Properties of optical propagation as well as interference in the sub-wavelength metallic waveguide based on the extraordinary transmission are investigated by the Finite Difference Time Domain(FDTD) method. And several parameters on the standing wave as well as the coupling of two standing waves are studied, which is useful to understand the properties of optical propagation and the extraordinary transmission in the sub-wavelength metallic waveguide. It shows that TE light field is hard to propagate efficiently in the sub-wavelength metallic waveguide as the waveguide width is much smaller than the half wavelength. The propagating distance of the TE light field will be larger with the increasing of the waveguide width and can propagate generally when the waveguide width is about or larger than the half wavelength. There is a cut-off wavelength in the waveguide and it is linearly proportional to the absorption coefficient of the metal. In addition, due to the extraordinary transmission, it generates the standing wave in the sub-wavelength metallic waveguide.

Keywords: Sub-wavelength metallic waveguide Property of propagation Interference FDTD

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