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Title:Numerical Study of Gain-Assisted Terahertz Hybrid Plasmonic Waveguide
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Abstract:A numerical transfer matrix method (TMM) is applied to investigate hybrid surface plasmon polaritons (HySPPs) waveguide structure, which consists of a high permittivity dielectric fiber separated from a metal surface with a low permittivity dielectric gap. The results obtained from the TMM agree well with those from the finite element method but with a faster calculation speed. As a demonstration example, we have systematically investigated the propagation properties of the gain-assisted HySPPs waveguide in the terahertz regime by using this method, studying the influences of structure parameters, frequency, temperature, and material gain. The results manifest that the effective index and the propagation loss decrease with the increase of temperature. In addition, as the frequency increases, the effective index increases and the propagation loss shows a peak. Furthermore, lossless propagation can be achieved when certain gain materials are applied into the HySPPs structure. Our method provides an efficient approach to investigate HySPPs waveguide and other plasmonic devices.
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