Finite elements method for modeling of optical excitation response: application for surface plasmon effect in nanostructures

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Abstract

In last decay, a number of numerical methods have been developed to give a description of the plasmon field. The inhomogeneity and complexity of these medium need higher accuracy. The FEM (Finite Element Method) is a powerful method for modelling the optical excitation response in the metal/dielectric nanostructures, this later phenomena caused the surface plasmon effect which is present important application in several domains such as bio-photonics. This method is based on solving partial differential equations such as electromagnetic wave propagation equation. It subdivided the total geometrical space in finite elements. Only with the development of calculator did it become possible to simulate a complex medium with FEM, because it costs more time and computation resources compared with other methods, but it usually have higher accuracy. Is first formulations were developed as matrix methods for structural mechanics. Then it's extended to the electromagnetic problem.

The advantage of this method to descript the optical response of nanostructures is that the FEM is discrete of the space into a set of triangular subunits, which are best suited to describe the near field in these nan-systems. Recent review of the literature for modelling the electric field enhancement and distribution around the nanosphere [1] and nanocube [2] on this method have been published. Actually, these devices are explored for sensing applications, guiding of light. In this work, we chose to study and modeling the optical near field excited in the metallic nanosphere and nanocube based on resolution of electromagnetic plane wave propagation equation in inhomogeneous media by the Finite Element method.

Keywords

Finite elements method, optical excitation response, surface plasmon effect, metallic nanostructures

References

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