SEGMENTED-WAVE ANALYSIS OF NANO-GRATINGS ON CURVED SURFACES

Muhammad Fayyaz Kashif [1,*], Filippo Pisano[2], Antonio Balena[2,3], Marco Pisanello[2], Tiziana Stomeo[2], Massimo De Vittorio[2,3], Ferruccio Pisanello[2], Antonella D'Orazio[1] and Marco Grande[1]

[1]Dipartimento di Ingegneria Elettrica e dell'Informazione, Politecnico di Bari, Bari, 70125, Italy
[2]Fondazione Istituto Italiano di Tecnologia, Center for Biomolecular Nanotechnologies, Arnesano (LE), 73010, Italy
[3]Dipartimento di Ingegneria Dell'Innovazione, Università del Salento, Lecce, 73100, Italy
**muhammadfayyaz.kashif@poliba.it*

In this paper, we investigate the gold nano-gratings on curved surfaces through numerical simulations. This study can be helpful to understand curvature induced effects in plasmonic devices.
Keywords: nano-gratings, surface plasmons

1. Abstract

Fiber-optic sensors have the advantages of design flexibility, miniaturization and remote sensing capability [1]. The ability to fabricate plasmonic nanostructures on the tip of a straight or tapered optical fiber can open doors to a wide range of sensing functionalities, especially for biomedical applications such as the analysis of neural circuits [2-4].
In this scenario, we detail on a gold nano-grating on a curved surface as shown in Figure 1(a) that resembles a fiber-based sensor. Numerical simulations are performed by the well-established numerical method rigorous coupled-wave analysis (RCWA). The surface curvature can be resolved by a segmentation-based approximation technique as depicted in Figure 1(b & c) [5]. For example, Figure 2 shows reflection spectra when the segmented-wave analysis is performed on a continuum film for different curvature radii. We analyse also different types of nano-gratings arranged in both one-dimensional and two-dimensional configurations.
The results from this analysis can be helpful to understand challenges that lie in the design and fabrication of plasmonic devices with a special focus on curvature induced effects and implications.

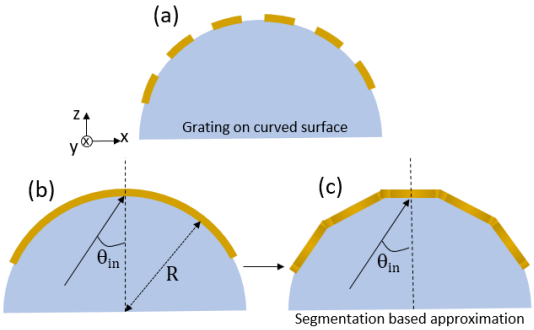

Fig. 1 (a) Schematic of a gold nano-grating on a curved surface. (b) Continuum gold film on a curved surface and (c) segmentation-based approximation of the structure in (b). θ_{in} is the impinging angle and R is the radius of curvature.

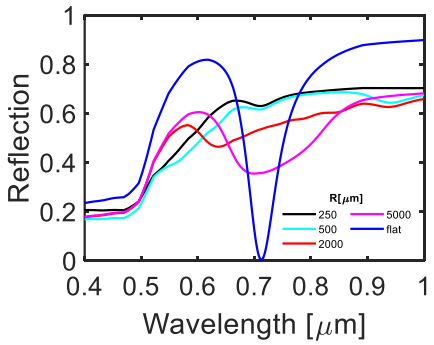

Fig. 2 Reflection spectra from a structure shown in Fig. 1(b) at various curvature radii.

References

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