Sandwich-type Coatings Comprising Conventional and Smart Materials. Resonant Blinding (Radiation) and Hiding (Absorption)

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The electromagnetic field interaction with a multilayered structure having a periodic interface and comprising slabs of smart artificial materials (e.g. metamaterial or graphene) is studied by means of the modified C-method furnished with certain elements of the analytical regularization technique.

To understand the process of interaction of electromagnetic radiation with complex structures, like the one depicted in Fig. 1, it is necessary to have a full picture of the behavior of its constitutive elements in the electromagnetic filed.

A special attention should be payed to the study of a dielectric slab with periodic interface. Such substrate is widely used for installing and growing graphene or metamaterials layers. It is responsible for protection and tuning, distortion of undesirable resonances, for hiding or for blinding [1]. Introduction of periodicity, which is a strongly transformative interface for electromagnetic waves, provides engineers with additional tools for electromagnetic control of coating sandwiches [2].

The process of interaction of electromagnetic waves with periodic interface of dielectric slab (backed with metamaterials or graphene monolayer in further applications) is modeled by means of a boundary value problem. It is resolved using the C-method with regularization [3], [4]. This approach ensures reliable results in numerical simulations. The predictable and set-in-advance accuracy of calculations is especially important for the study of super high-Q resonances, which are typical to the structures of interest.

Extensive research on the control of resonances by optimizing the geometry of the structure and changing their electromagnetic properties has been carried out.

The obtained results could serve as a basis for applications of smart coatings in various wavelength ranges and geometrical scales.





Figure 1. Geometry of the problem

References

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