Enhanced Field Localization through Nested Cavity Resonators

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Field localization, useful for applications such as lasers, non-linear devices, and filters, can be obtained through open cavity resonators [1]. A region bounded by metasurfaces with antagonistic natures (inductive/capacitive) offers a flexible platform to generate a standing wave with required properties. Parameters as field localization, contrast, and quality factor can be improved when both metasurfaces behave closely to a perfect electric conductor (PEC). Unfortunately, current state-of-the-art in fabrication techniques limits resonators based on near-PEC metasurfaces with matched capacitive and inductive behaviors.

In this work, we propose to exploit the zero-scattering properties of an invisible resonator in order to design a nested cavity, as shown in Fig.1. The standing wave of the inner resonator is fed by the waves scattered by the outer resonator. On the other hand, the entire structure remains invisible, regardless of its position with respect to the source of incident radiation, as the total scattering from the nested resonators vanishes in all directions. Therefore, this nested resonator can achieve high field localization with feasible metasurfaces. In addition, field localization can be adjusted through simple displacement of the inner resonator within the outer one. The adaptive localization can be useful in scenarios where an object inside the structure should be illuminated progressively to prevent unexpected scattering.

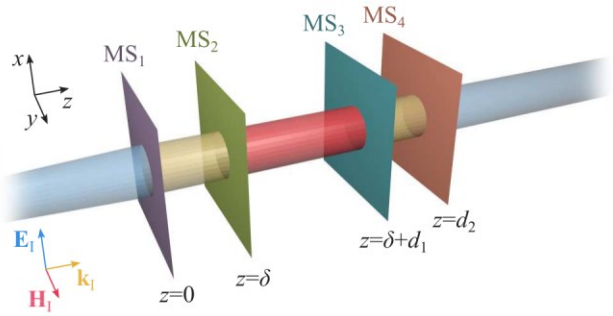

Fig. 1: Concept of nested invisible cavity resonators

References

[1] F.S. Cuesta, V.S. Asadchy, A.D. Sayanskiy, V.A. Lenets, M.S. Mirmoosa, X. Ma, S.B. Glybovski, and S.A. Tretyakov, "Non-scattering Metasurface-bound Cavities for Field Localization, Enhancement, and Suppression," to appear in IEEE Transactions on Antennas and Propagation.