Plane Wave Scattering by an Array of Pseudochiral Cylinders

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This paper presents the analysis of electromagnetic plane wave scattering by cylindrical objects made of pseudochiral material located in free space.

Presented approach is based on the Iterative Scattering Procedure (ISP) [1] and allows to define the total scattered field from arbitrary configurations of cylinders. To take into account practical applications two layered cylindrical object is defined. As shown in Fig. 1 the inner dielectric or metallic core is covered with the pseudochiral material. For configuration from Fig. 1 assuming TM^z excitation and homogeneity of the field along z axis, the following wave equation is obtained [1, 2].

$$\rho\frac{\partial}{\partial\rho}\left(\rho\frac{\partial E_z}{\partial\rho}\right)+k_o^2\varepsilon_z\mu\rho^2E_z+\frac{\mu}{\mu_\rho}\frac{\partial^2E_z}{\partial\phi^2}=0 \qquad (1)$$

It is important to note that the elements $\varepsilon_z \neq \varepsilon$ and $\mu_\rho \neq \mu$ indicate the pseudochirality effect in the considered cylinder.

The results of numerical experiment for the configuration of three pseudochiral cylinders have been presented in Fig. 2. It can be noticed that the level of side lobes for pseudochiral cylinders (Fig. 2b) decreases significantly in comparison to the configuration of dielectric posts (Fig. 2a).

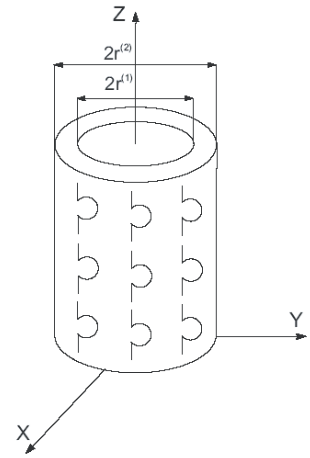

Figure 1: Pseudochiral cylinder geometry.

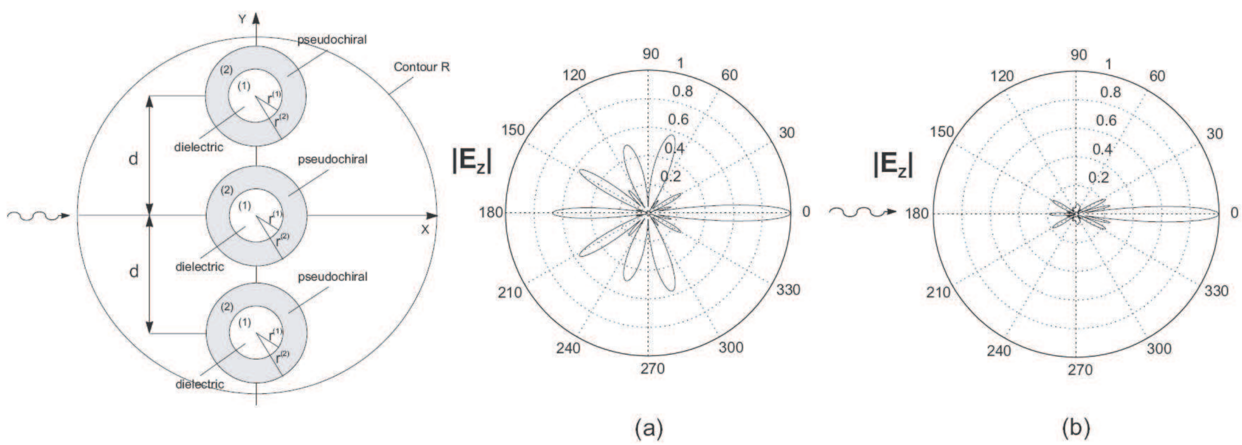

Figure 2: Scattering characteristics of $|E_z|$ for TM^z excitation from three pseudochiral cylinders. Plane wave excitation along x-axis direction. Dimensions: $r^{(1)} = 0.4\lambda$, $r^{(2)} = 0.75\lambda$, $R = 3\lambda$, $d = 2\lambda$, $\rho = 100\lambda$, $M = N = 26$: (a) dielectric cylinders: layer (1) $\varepsilon^{(1)} = 2$, layer (2) (host medium) $\varepsilon^{(2)} = 4$, $\varepsilon_z^{(2)} = 4$, (b) pseudochiral cylinders: layer (1) $\varepsilon^{(1)} = 2$, layer (2) $\varepsilon^{(2)} = 4$, $\varepsilon_z^{(2)} = 9$, $\mu^{(2)} = 1$, $\mu_\rho^{(2)} = 1.5$.

REFERENCES

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2. Engheta, N. and M. M. Saadoun, "Novel pseudochiral or Ω-medium and its applications," *Proc. of PIERS91*, Cambridge, MA, 339, July 1991.