

**Blåsten, Emilia; Liu, Hongyu; Xiao, Jingni**

**On an electromagnetic problem in a corner and its applications.** (English) Zbl 1480.78011  
*Anal. PDE* 14, No. 7, 2207-2224 (2021).

Summary: Let  $\mathcal{K}_{x_0}^{r_0}$  be a (nondegenerate) truncated corner in  $\mathbb{R}^3$ , with  $x_0 \in \mathbb{R}^3$  being its apex, and  $\mathbf{F}_j \in C^\alpha(\overline{\mathcal{K}_{x_0}^{r_0}}; \mathbb{C}^3)$ ,  $j = 1, 2$ , where  $\alpha$  is the positive Hölder index. Consider the electromagnetic problem

$$\begin{cases} \nabla \wedge \mathbf{E} - i\omega\mu_0\mathbf{H} = \mathbf{F}_1 & \text{in } \mathcal{K}_{x_0}^{r_0}, \\ \nabla \wedge \mathbf{H} + i\omega\varepsilon_0\mathbf{E} = \mathbf{F}_2 & \text{in } \mathcal{K}_{x_0}^{r_0}, \\ \nu \wedge \mathbf{E} = \nu \wedge \mathbf{H} = 0 & \text{on } \partial\mathcal{K}_{x_0}^{r_0} \setminus \partial B_{r_0}(x_0), \end{cases}$$

where  $\nu$  denotes the exterior unit normal vector of  $\partial\mathcal{K}_{x_0}^{r_0}$ . We prove that  $\mathbf{F}_1$  and  $\mathbf{F}_2$  must vanish at the apex  $x_0$ . There is a series of interesting consequences of this vanishing property in several separate but intriguingly connected topics in electromagnetism. First, we can geometrically characterize nonradiating sources in time-harmonic electromagnetic scattering. Secondly, we consider the inverse source scattering problem for time-harmonic electromagnetic waves and establish the uniqueness result in determining the polyhedral support of a source by a single far-field measurement. Thirdly, we derive a property of the geometric structure of electromagnetic interior transmission eigenfunctions near corners. Finally, we also discuss its implication to invisibility cloaking and inverse medium scattering.

**MSC:**

- 78A46 Inverse problems (including inverse scattering) in optics and electromagnetic theory
- 78A45 Diffraction, scattering
- 35Q61 Maxwell equations
- 35P25 Scattering theory for PDEs
- 35R30 Inverse problems for PDEs

Cited in **3** Documents

**Keywords:**

Maxwell system; corner singularity; invisible; vanishing; interior transmission eigenfunction; inverse scattering; single far-field measurement

**Full Text:** [DOI](#) [arXiv](#)