On a semilinear equation involving the curl-curl operator

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We present recent joint work with J. Mederski on solutions $E:\Omega\to\mathbb{R}^3$ of the problem

$$\begin{cases} \nabla\times(\nabla\times E)+\lambda E=\partial_E F(x,E) & \text{in } \Omega \\ \nu\times E=0 & \text{on } \partial\Omega \end{cases}$$

on a simply connected, smooth, bounded domain $\Omega\subset\mathbb{R}^3$ with connected boundary and exterior normal $\nu:\partial\Omega\to\mathbb{R}^3$. Here $\nabla\times$ denotes the curl operator in $\mathbb{R}^3$, the nonlinearity $F:\Omega\times\mathbb{R}^3\to\mathbb{R}$ is superquadratic and subcritical in E. The model nonlinearity is of the form $F(x,E)=\Gamma(x)|E|^p$ for $\Gamma\in L^\infty(\Omega)$ positive, some $2<p<6$. It need not be radial nor even in the E-variable. The problem comes from the time-harmonic Maxwell equations, the boundary conditions are those for Ω surrounded by a perfect conductor.