An inverse problem originating from magnetohydrodynamics

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Abstract

We are concerned with the possibility of identifying the real parameters a and b on the right-hand side of the equation

$$\Delta u = au + b \geq 0 \quad \text{in} \quad \omega \Subset \mathbb{R}^2$$

for a function u satisfying the boundary conditions

$$u = 0, \quad \partial u/\partial \nu = \Phi \quad \text{on} \quad \partial\omega$$

with any fixed sufficiently smooth function $\Phi \not\equiv 0$.

In the case of a smooth curve $\gamma = \partial\omega$, we provide a sufficient condition, under which the pair (a, b) can be uniquely reconstructed through the specified function Φ. On the basis of this sufficient condition, we show that there are at most finitely many pairs (a, b) if ω is (simply connected and) different from a disk.