

**Howison, S. D.; Rodrigues, J. F.; Shillor, M.**

**Stationary solutions to the thermistor problem.** (English) Zbl 0787.35033  
J. Math. Anal. Appl. 174, No. 2, 573-588 (1993).

The authors consider the nonlinear problem

$$-\nabla \cdot (k(u)\nabla u) = \sigma(u)|\nabla\varphi|^2, \quad \nabla \cdot (\sigma(u)\nabla\varphi) = 0 \quad (*)$$

in a bounded domain  $\Omega \subset \mathbb{R}^n$ ,  $n \geq 2$ , with Lipschitz boundary and with general mixed boundary conditions, which is a mathematical model for the description of the steady state distribution of the temperature  $u$  and the electrical potential  $\varphi$  in an electric device (thermistor) whose electrical properties are temperature dependent.

The existence of a weak solution of (\*) for general boundary conditions is proved under the sole assumption that  $\sigma$  is continuous and uniformly positive. Uniqueness of the solution is also proved for sufficiently small data. Then, a new nonlocal condition which relates to the way the device is connected to the rest of the electrical circuit is analyzed, and sufficient conditions for the existence of a weak solution for such a problem are derived. Finally, a sufficient condition for non- uniqueness of the problem in one space dimension is given.

Reviewer: [I.Zino \(St.Peterburg\)](#)

**MSC:**

[35J65](#) Nonlinear boundary value problems for linear elliptic equations  
[35J55](#) Systems of elliptic equations, boundary value problems (MSC2000)  
[35Q80](#) Applications of PDE in areas other than physics (MSC2000)

Cited in **43** Documents

**Keywords:**

quasilinear elliptic system; existence of weak solutions; uniqueness for small data; mixed boundary conditions; electric device (thermistor)

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