Unique solvability of an inverse problem for a semilinear equation with final overdetermination

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Abstract: This study is devoted to the investigation of unique solvability of the inverse problem governed by a semilinear equation subject to a final overdetermination

$$(1) \qquad \begin{cases} \frac{du}{dt} + Au\,(t) = f\,(t, u(t)) + p,\ 0 < t < T, \\ \\ u\,(0) = \varphi,\ u\,(T) = \psi \end{cases}$$

in an arbitrary Banach space E. Here, A is a linear operator acting in E, with domain $D\,(A)$. Assume that $-A$ is the generator of the analytic semigroup $\exp\{-tA\}$ with an exponentially decreasing norm

$$(2) \qquad \left\|e^{-tA}\right\|_{E\to E} \leq Me^{-\delta t},\ t\left\|Ae^{-tA}\right\|_{E\to E} \leq M,\ t \geq 0.$$

For the numerical solution of this problem the first order of accuracy Rothe difference scheme is proposed. The existence and uniqueness results for this difference scheme is given. As an application, an inverse problem governed by a semilinear parabolic equation subject to a final overdetermination is considered.

Throughout this note we mainly use techniques from [1, 2].

Keywords: Existence and uniqueness, semilinear equation, inverse problem, final overdetermination, difference scheme

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References

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