

Mathematical Analysis of free boundary problems related to a variational problem

メタデータ	言語: jpn 出版者: 公開日: 2022-05-13 キーワード (Ja): キーワード (En): 作成者: Omata, Seiro メールアドレス: 所属:
URL	https://doi.org/10.24517/00066000

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1998 Fiscal Year Final Research Report Summary

Mathematical Analysis of free boundary problems related to a variational problem

Research Project

Project/Area Number

09640170

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

解析学

Research Institution

Kanazawa University

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Project Period (FY)

1997 - 1998

Keywords

Free boundary problem / Variational problem / Nonlinear partial differential equations / Numerical Analysis / Minimizing methods / Superconductivity / Liquid crystals

Research Abstract

We mainly investigated a free boundary problem related to a variational problem. Since our problem has a feature (that the free boundary is a set of singular points of a minimizer and the energy concentrate on it). So, we can consider that our purpose is on treating the energy concentration phenomena on the singularity of solutions. In this stand point of view, we treated the following type of problems :

- (1) Develop Regularity theory of elliptic free boundary problem related to minimizing functional with moving boundary,
- (2) Develop a Numerical method via a minimization process,
- (3) Develop a method related to solve a hyperbolic free boundary problem.

For problem (1), in 2-dimensional case, we successfully showed regularity of free boundary on some nonlinear case. For (2), we treated the Ginzburg-Landau functional which mainly appear in superconducting phenomena. In this, we developed a method due to discrete Morse semiflow for parabolic and hyperbolic problems. For (3), we constructed a strong solutions related to hyperbolic free boundary problems under some compatibility conditions. Moreover we developed a software to solve this with good accuracy. We summed up these results into 7 papers (appeared or in press) and 1 preprint (submitted).

Research Products (15 results)

All Other

All Publications (15 results)

- [Publications] S.Omata: "A Numerical Method based on the discrete Morse semiflow related to parabolic and hyperbolic equations" Nonlinear Analysis. 30 No.4. 2181-2187 (1997) ▼
- [Publications] K.Kikuchi S.Omata: "A free boundary problem for a one dimensional hyperbolic equation" Adv.Math.Sci.Appl.10 No.1 to appear. ▼
- [Publications] S.Omata Y.Yamaura: "A free boundary problem for quasilinear elliptic equations part II: $C^{1,\alpha}$ -regularity of free boundary" Funkcialaj Ekvacioj. 42 No.1 to appear. ▼
- [Publications] T.Nagasawa K.Nakane S.Omata: "Hyperbolic Ginzburg Landau system" Nonlinear Analysis. to appear. ▼
- [Publications] S.Omata T.Okamura K.Nakane: "Numerical analysis for the discrete Morse semiflow related to the Ginzburg Landau functional" Nonlinear Analysis. to appear. ▼
- [Publications] T.Nagasawa K.Nakane S.Omata: "Numerical computations for a hyperbolic Ginzburg-Landau system" in proc.Eighth Int.Col.on Differential Equations,Plovdiv. 18-23 (1997) ▼
- [Publications] H.Imai,S.Omata,K.Nakane K.Kikuchi: "Numerical analysis of a free boundary problem governed by a hyperbolic equation" in Proc.Third China-Japan Seminar on Numerical Mathematics,Science Press Beijing New York. 214-221 (1998) ▼
- [Publications] S.Omata: "A Numerical Method based on the discrete Morse semiflow related to parabolic and hyperbolic equations" Nonlinear Analysis. Vol.30, No.4. 2181-2187 (1997) ▼
- [Publications] T.Nagasawa, K.Nakane and S.Omata: "Numerical computations for a hyperbolic Ginzburg-Landau system" in Proceedings of the Eighth International Colloquium on Differential Equations Plovdiv, Bulgaria, August. 18-23 (1997) ▼
- [Publications] H.Imai, S.Omata, K.Nakane and K.Kikuchi: "Numerical analysis of a free boundary problem governed by a hyperbolic equation" in Proc.Third China-Japan Seminar on Numerical Mathematics, edited by Zhong-Ci Shi and Masataka Mori, Science Press Beijing New York. 214-221 (1998) ▼
- [Publications] S.Omata, T.Okamura and k.Nakane: "Numerical analysis for the discrete Morse semiflow related to the Ginzburg Landau functional ;" Nonlinear Analysis. (to appear.). ▼
- [Publications] K.Kikuchi and S.Omata: "A free boundary problem for a one dimensional hyperbolic equation" Adv.Math.Sci.Appl.Vol.10 No.1(to appear.). ▼
- [Publications] S.Omata and Y.Yamaura: "A free boundary problem for quasilinear elliptic equations part II : $C^{1,\alpha}$ -regularity of free boundary" Funkcialaj Ekvacioj. Vol.42.No.1.(to appear). ▼
- [Publications] T,Nagasawa, K.Nakane and S.Omata: "Hyperbolic Ginzburg Landau system" Nonlinear Analysis. (to appear.). ▼

[Publications] H.Imai, K.Kikuchi, K.Nakane, S.Omata and T.Tachikawa: "Numerical analysis of a free boundary problem for one dimensional hyperbolic equation" (preprint.).



URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-09640170/096401701998kenkyu_seika_hokoku_

Published: 1999-12-07