Mathematical Analysis of partial differential equations related to a variational problem via the discrete Morse Semiflows

2000 Fiscal Year Final Research Report Summary

Mathematical Analysis of partial differential equations related to a variational problem via the discrete Morse Semiflows

Research Project

Project/Area Number

11640159

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Basic analysis

Research Institution

Kanazawa University

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1999 – 2000

Keywords

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

Research Abstract

We mainly investigated partial differential equations related to a variational problem via the discrete Morse semiflows. Our main interest is on sets of singular points of a solutions. Such sets has sometimes big energy concentrate on it. So, we can cosider 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 a prallel machine for solving mininizing problems,
(2) Develop a Numerical method via a minimization process,
(3) Develop a method to solve both parabolic and hyperbolic equations via minimizing.
For these problems, we have developped a 8-CPU parallel computer for solving minimizing problems. By use of this, we did a numerical copmutations to catch the structure of singularities for eikonal equation, Ginzburg-Landau system, and smestics liquid crystal problems. Basic method due to discrete Morse semiflow for parabolic and hyperbolic problems.
We also solved the asymptotic behavior of solitary wave solutions for BBM-Burgers equations.
Moreover we developped a software to solve hyperbolic free boundary problems. This is based on the smoothing method of a equation and we can get good results even when the free boundary changes its topology.
We summed up these results into 8 papers (appeared or in press) and 2 preprint (submitted).

Research Products (16 results)

All | Other

All | Publications

[Publications] K.Kikuchi,S.Omata: "A free boundary problem for a one dimensional hyperbolic equation"Adv.Math.Sci.Appl.. 10 No.1. 775-786 (1999)

[Publications] S.Omata,Y.Yamaura: "A free boundary problem for quasilinear elliptic equations part II : C^<1,α>-regularity of free boundary"Funkcialaj Ekvacioj. 42 No.1. 9-70 (1999)

[Publications] S.Omata,T.Okamura,K.Nakane: "Numerical analysis for the discrete Morse semiflow related to the Ginzburg Landa functional"Nonlinear Analysis. 37 No.5. 589-602 (1999)

[Publications] S.Kinami,M.Mei,S.Omata: "Asymptotic Toward Diffusion Waves of the Solutions for Benjamin-Bona-Mahony-Burgers Equations"Applicable Analysis. 75(3-4). 317-340 (2000)

[Publications] H.Imai,K.Kikuchi,K.Nakane,S.Omata,T.Tachikawa: "A Numerical Approach to the Asymptotic Bbehavior of Solutions of a One-Dimensional Free Boundary Problem of Hyperbolic Type"Japan Journal of Industrial and Applied Mathematics. 18(1). 43-58 (2001)

[Publications] S.Omata,S.Kinami: "A numerical approach to the eikonal equation"Nonlinear Analysis. (to appear).

[Publications] S.Omata,H.Iwasaki,K.Kawagoe: "Numerical calculations for the eikonal equation via the discrete Morse semiflow with Ginzburg-Landau energy"Adv.Math.Sci.Appl.. 11(2)(to appear). (2001)

[Publications] T.Nagasawa,K.Nakane,S.Omata: "Numerical computations for movement of vortices governed by a hyperbolic Ginzburg Landau system"Nonliear Analysis. (to appear).

[Publications] S.Omata, T.Okamura and K.Nakane: "Numerical analysis for the discrete Morse semiflow related to the Ginzburg Landau functional"Nonlinear Analysis. 37, No.5. 589-602 (1999)

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