

# Nonlinear Stability of Shock Fronts for a Relaxation System in Several Space Dimensions

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We study the nonlinear asymptotic stability of planar shock front for a class of relaxation systems which approximate scalar conservation laws in several space dimensions time asymptotically. It is shown that if the relaxation system satisfies the subcharacteristic condition, then a traveling wave solution connecting a weak entropy shock is asymptotically stable under small generic perturbations. © 1997 Academic Press

## 1. INTRODUCTION AND MAIN THEOREM

It is proposed by Jin and Xin in [JX] to use the relaxation system

$$u_t + \sum_{i=1}^m (v_i)_{x_i} = 0, \quad u \in R^n, \quad v_i \in R^n, \quad (1.1)$$

$$v_{it} + A_i u_{x_i} = -\frac{(v_i - F_i(u))}{\varepsilon}, \quad i = 1, 2, \dots, m \quad (1.2)$$

to approximate scalar multi-dimensional hyperbolic conservation laws of the form

$$u_t + \sum_{i=1}^m F_i(u)_{x_i} = 0, \quad (x_i, t) \in R^1 \times R^+, \quad u \in R^n. \quad (1.3)$$

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# Stability Of Multi Dimensional Shock Fronts

**Eitan Tadmor, Jian-Guo Liu, Athanasios  
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## **Stability Of Multi Dimensional Shock Fronts:**

**The Stability of Multi-Dimensional Shock Fronts** Andrew Majda,1983 A systematic study of the linearized stability of multi dimensional shock front solutions of a system of hyperbolic conservation laws is developed      **Analytical Approaches**

**to Multidimensional Balance Laws** Olga S. Rozanova,2006 It is difficult to overestimate the importance of mathematical investigation of balance laws They arise in many areas of physics mechanics chemistry biology social sciences In this collective book we concentrate in particular on the equations of continuous medium and related to them As a rule they are very complicated in their primitive form An important feature of such equations is a possible formation of singularities even in initially smooth solution within a finite time The structure of the singularities can be very complex A natural step in the approach to this problem is the transition despite the three dimensionality of our world to spatially one dimensional model Significant progress has been achieved in this direction Unfortunately the methods of the one dimensional theory as usual cannot be adapted to a case of many spatial variables However there are many attempts to deal with multidimensional problems We would like to present some of them All of the papers are written by outstanding experts representing various schools in mathematics and mechanics Each paper is organised as follows it contains an elementary as far as it is possible introduction to a problem a brief review of previously published results and then original results of the authors are presented

*Hyperbolic Problems: Theory, Numerics and Applications* Eitan Tadmor,Jian-Guo Liu,Athanasios E. Tzavaras,2009 The International Conference on Hyperbolic Problems Theory Numerics and Applications HYP2008 was held at the University of Maryland from June 9 13 2008 This was the twelfth meeting in the bi annual international series of HYP conferences which originated in 1986 at Saint Etienne France and over the last twenty years has become one of the highest quality and most successful conference series in Applied Mathematics This book the first in a two part volume contains nineteen papers based on plenary and invited talks presented at the conference These original research and review papers written by leading experts as well as promising young scientists represent the state of the art research frontiers in hyperbolic equations and related problems ranging from theoretical analysis to algorithm development and applications in physical sciences and engineering This volume will bring readers to the forefront of research in this most active and important area in applied mathematics

*Handbook of Mathematical Fluid Dynamics* S. Friedlander,D. Serre,2004-11-20 The Handbook of Mathematical Fluid Dynamics is a compendium of essays that provides a survey of the major topics in the subject Each article traces developments surveys the results of the past decade discusses the current state of knowledge and presents major future directions and open problems Extensive bibliographic material is provided The book is intended to be useful both to experts in the field and to mathematicians and other scientists who wish to learn about or begin research in mathematical fluid dynamics The Handbook illuminates an exciting subject that involves rigorous mathematical theory applied to an important physical problem namely the motion of fluids      *Multi-dimensional Shock Front for Transonic Flow Equations*

Enrique Alberto Thomann,1985      *Fifth International Congress of Chinese Mathematicians* Lizhen Ji,2012 This two part volume represents the proceedings of the Fifth International Congress of Chinese Mathematicians held at Tsinghua University Beijing in December 2010 The Congress brought together eminent Chinese and overseas mathematicians to discuss the latest developments in pure and applied mathematics Included are 60 papers based on lectures given at the conference      **Hyperbolic Problems: Theory, Numerics, Applications** Thomas Y. Hou,Eitan Tadmor,2012-12-06 The International Conference on Hyperbolic Problems Theory Numerics and Applications was held in CalTech on March 25 30 2002 The conference was the ninth meeting in the bi annual international series which became one of the highest quality and most successful conference series in Applied mathematics This volume contains more than 90 contributions presented in this conference including plenary presentations by A Bressan P Degond R LeVeque T P Liu B Perthame C W Shu B Sj green and S Ukai Reflecting the objective of series the contributions in this volume keep the traditional blend of theory numerics and applications The Hyp2002 meeting placed a particular emphasize on fundamental theory and numerical analysis on multi scale analysis modeling and simulations and on geophysical applications and free boundary problems arising from materials science and multi component fluid dynamics The volume should appeal to researchers students and practitioners with general interest in time dependent problems governed by hyperbolic equations      Multi-dimensional hyperbolic partial differential equations Sylvie Benzoni-Gavage,Denis Serre,2006-11-23 Authored by leading scholars this comprehensive self contained text presents a view of the state of the art in multi dimensional hyperbolic partial differential equations with a particular emphasis on problems in which modern tools of analysis have proved useful Ordered in sections of gradually increasing degrees of difficulty the text first covers linear Cauchy problems and linear initial boundary value problems before moving on to nonlinear problems including shock waves The book finishes with a discussion of the application of hyperbolic PDEs to gas dynamics culminating with the shock wave analysis for real fluids With an extensive bibliography including classical and recent papers both in PDE analysis and in applications mainly to gas dynamics this text will be valuable to graduates and researchers in both hyperbolic PDEs and compressible fluid dynamics      **Advances in Differential Equations** ,2006      *Discrete and Continuous Dynamical Systems* ,2009      *Reviews in Partial Differential Equations, 1980-86, as Printed in Mathematical Reviews* ,1988      **Hyperbolic Problems** Eitan Tadmor,Jian-Guo Liu,Athanasios E. Tzavaras,2009 The International Conference on Hyperbolic Problems Theory Numerics and Applications HYP2008 was held at the University of Maryland from June 9 14 2008 This was the twelfth meeting in the bi annual international series of HYP conferences which originated in 1986 at Saint Etienne France and over the last twenty years has become one of the highest quality and most successful conference series in Applied Mathematics The articles in this two part volume are written by leading researchers as well as promising young scientists and cover a diverse range of multi disciplinary topics addressing theoretical modeling and computational issues arising under the umbrella of hyperbolic PDEs This volume will bring readers

to the forefront of research in this most active and important area in applied mathematics     *Handbook of Differential Equations: Evolutionary Equations* C.M. Dafermos, Eduard Feireisl, 2004 This book contains several introductory texts concerning the main directions in the theory of evolutionary partial differential equations The main objective is to present clear rigorous and in depth surveys on the most important aspects of the present theory     *Methods and Applications of Analysis*, 2001     **Journal of Differential Equations**, 2002-02     **Hokkaido Mathematical Journal**, 1982     **Stability of Shock Fronts for Multidimensional Conservation Laws** Włodzimierz Domanski, 1989     Annales Scientifiques de L'École Normale Supérieure École normale supérieure (France), 2008     **Catalogue, Books and Journals in Advanced Mathematics** American Mathematical Society, 1984     Abstracts of Papers Presented to the American Mathematical Society American Mathematical Society, 1988

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