

ISSN 1881-6193

RIMS Kôkyûroku Bessatsu B57

**Several aspects of
microlocal analysis**

edited by Naofumi Honda, Yasunori Okada and Susumu Yamazaki

May, 2016

**Research Institute for Mathematical Sciences
Kyoto University**

RIMS Kôkyûroku Bessatsu B57

Several aspects of microlocal analysis

October 20 ~24, 2014

edited by Naofumi Honda, Yasunori Okada and Susumu Yamazaki

May, 2016

Research Institute for Mathematical Sciences

Kyoto University, Kyoto, Japan

The papers presented in this volume of RIMS Kôkyûroku Bessatsu are in final form and refereed.
©2016 by the Research Institute for Mathematical Sciences, Kyoto University. All rights reserved.
Printed in Japan.

PREFACE

This volume presents a collection of research and survey articles which were contributed by invited speakers in the RIMS workshop “Several aspects of microlocal analysis” held at Research Institute for Mathematical Sciences (RIMS), Kyoto University from 20 through 24 October, 2014, in which experts from many areas of mathematics participated.

NAOFUMI HONDA
YASUNORI OKADA
SUSUMU YAMAZAKI

PROGRAM

RIMS Workshop on

Several aspects of microlocal analysis

Organizers: NAOFUMI HONDA (Hokkaido Univ.),
YASUNORI OKADA (Chiba Univ.) and SUSUMU YAMAZAKI (Nihon Univ.)

October 20 (Mon.)–24 (Fri.), 2014, Room No. 111 of RIMS, Kyoto University

October 20, Monday

- 10:00 - 10:50 Shinya Moritoh (Nara Women's Univ.)
Detection of singularities in wavelet and ridgelet analyses
- 11:10 - 12:00 Hideshi Yamane (Kwansei Gakuin Univ.)
Asymptotics for the defocusing integrable discrete nonlinear Schrödinger equation
- 13:40 - 14:30 Akira Shudo (Tokyo Metropolitan Univ.)
Quantum tunneling in nonintegrable systems: beyond the leading order WKB description
- 14:50 - 15:40 Sampei Hirose (Shibaura Institute of Technology)
On unfoldings of differential operators
- 16:00 - 16:50 Takashi Aoki (Kindai Univ.)
The hypergeometric function and WKB solutions

October 21, Tuesday

- 10:00 - 10:50 Yasunori Okada (Chiba Univ.)
Solvability of coupling equations and infinite dimensional holomorphy
- 11:10 - 12:00 Toshinori Oaku (Tokyo Woman's Christian Univ.)
Annihilators of Laurent coefficients of the complex power of a real analytic function – example and algorithm
- 13:40 - 14:30 Kunio Yoshino (Tokyo City Univ.)
Spectral analysis of Toeplitz operators on Bargmann - Fock space via hyperfunctions
- 14:50 - 15:40 Kohei Umeta (Hokkaido Univ.) and Naofumi Honda (Hokkaido Univ.)
On the construction of Laplace transforms for Laplace hyperfunctions
- 16:00 - 16:50 Hidetoshi Tahara (Sophia Univ.)
q-Analogues of Laplace and Borel transforms by using q-exponentials

October 22, Wednesday

- 10:00 - 10:50 Luca Prelli (Univ. Lisbon), Naofumi Honda (Hokkaido Univ.) and Susumu Yamazaki (Nihon Univ.)
Multi-microlocalization
- 11:10 - 12:00 Keisuke Uchikoshi (National Defense Academy of Japan)
Singularities in a compressible perfect fluid
- 13:40 - 14:30 Yoko Umeta (Tokyo Univ. of Science) and Shinichi Tajima (Tsukuba Univ.)
On the monodromy structure of holonomic D -modules associated with simple line singularities
- 14:50 - 15:40 Joe Kamimoto (Kyushu Univ.)
On local zeta functions in two dimensions
- 16:00 - 16:50 Kiyoomi Kataoka (Univ. Tokyo)
A review of the results on second analytic singularities in diffraction problems, and some geometric proofs

October 23, Thursday

- 10:00 - 10:50 Susumu Yamazaki (Nihon Univ.)
Boundary value problem for hyperfunction solutions to Fuchsian systems
- 11:10 - 12:00 Takashi Takiguchi (National Defense Academy of Japan)
On uniqueness problems for the Radon transform
- 13:40 - 14:30 Naofumi Honda (Hokkaido Univ.) and Takahiro Kawai (RIMS)
A study of pinch points and cups in the Landau-Nakanishi geometry
- 14:50 - 15:40 Tatsuya Koike (Kobe Univ.)
On Voros coefficients and middle convolutions for linear ordinary differential equations with a large parameter
- 16:00 - 16:50 David Sauzin (French National Center for Scientific Research)
Nonlinear analysis with resurgent functions, I

October 24, Friday

10:00 - 10:50 David Sauzin (French National Center for Scientific Research)
Nonlinear analysis with resurgent functions, II

11:10 - 12:00 Shingo Kamimoto (RIMS), Takahiro Kawai (RIMS) and Tatsuya Koike (Kobe Univ.)
Exact WKB analysis of simple pole type operators — alien calculus using the differential operators of infinite order

13:40 - 14:30 Hidekazu Ito (Kanazawa Univ.)
Some aspects of integrability of vector fields and normal form theory

14:50 - 15:40 Kohei Iwaki (RIMS)
Exact WKB analysis and cluster algebras

16:00 - 16:50 Masafumi Yoshino (Hiroshima Univ.)
Monodromy of confluent hypergeometric system

CONTENTS

PREFACE	i
PROGRAM	ii
ARTICLES	
1. SHINYA MORITOH, Detection of singularities in wavelet and ridgelet analyses	1
2. HIDESHI YAMANE, Asymptotics for the defocusing integrable discrete nonlinear Schrödinger equation	15
3. AKIRA SHUDO, YASUTAKA HANADA and KENSUKE S. IKEDA, Quantum tunneling in nonintegrable systems: beyond the leading order semiclassical description	27
4. SAMPEI HIROSE, On the redundant and non-redundant virtual turning points for the AKT equation	39
5. TAKASHI AOKI, TOSHINORI TAKAHASHI and MIKA TANDA, The hypergeometric function and WKB solutions	61
6. YASUNORI OKADA, REINHARD SCHÄFKE and HIDETOSHI TAHARA, Unique solvability of coupling equations in holomorphic functions	69
7. TOSHINORI OAKU, Annihilators of Laurent coefficients of the complex power for normal crossing singularity	79
8. KOHEI UMETA, A Laplace transform of Laplace hyperfunctions in several variables	85
9. NAOFUMI HONDA, LUCA PRELLI and SUSUMU YAMAZAKI, Multi-microlocalization	93
10. KEISUKE UCHIKOSHI, Singularities in a compressible perfect fluid	117
11. SHINICHI TAJIMA and YOKO UMETA, Computing structures of holonomic D-modules associated with a simple line singularity	125
12. JOE KAMIMOTO and TOSHIHIRO NOSE, On the asymptotic expansion of oscillatory integrals with smooth phases in two dimensions	141
13. KIYOOMI KATAOKA, A review of the results on second analytic singularities in diffraction problems	159
14. SUSUMU YAMAZAKI, Boundary value problem for Hyperfunction solutions to Fuchsian systems	175
15. NAOFUMI HONDA and TAKAHIRO KAWAI, A study of pinch points and cusps in the Landau-Nakanishi geometry	195
16. SHINGO KAMIMOTO and DAVID SAUZIN, Nonlinear analysis with endlessly continuable functions	235

17.	HIDEKAZU ITO, Some remarks on integrability and normal forms for vector fields	249
18.	KOHEI IWAKI, Exact WKB analysis, cluster algebras and Fock-Goncharov coordinates	265
19.	MASAFUMI YOSHINO, Monodromy of confluent hypergeometric system of Okubo type	281