Further Development of Trotter Product Formulas with Problems on Path Integrals

メタデータ	言語: jpn
	出版者:
	公開日: 2021-10-29
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	キーワード (En):
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URL	https://doi.org/10.24517/00063269
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2006 Fiscal Year Final Research Report Summary

Further Development of Trotter Product Formulas with Problems on Path Integrals

Research Project

Project/Area Number
16340038
Research Category
Grant-in-Aid for Scientific Research (B)
Allocation Type
Single-year Grants
Section
一般
Research Field
Basic analysis
Research Institution
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Project Period (FY)
2004 – 2006
Keywords
Trotter product formula / Trotter-Kato product formula / Lie-Trotter-Kato product formula / exponential product formula / path integral / SchrOdinger operator / time-

Research Abstract

sliced approximation

In two papers in Commun.Math.Phys. 2001, Ichinose, with Hideo Tamura, Hiroshi Tamura and V.A.Zagrebnov, proved norm convergence of Trotter product formula for the operator sum of two nonnegative selfadjoint operators with optimal error bound. The present research has been done to go beyond this result, keeping in mind its relation to path integral and examples/applications of the theory of Schrodinger operators, and brought the following results.

(1)Further development of Trotter product formula in norm-It is known that the norm convergence of Trotter product formula does not hold in general for the form sum of two selfadjoint operators. However, it was proved in J. Functional Analysis 2004 with some condition by Ichinose together with H. Neidhardt and V.A. Zagrebnov. It is an open problem whether the condition may be relaxed. To be unexpected, Ichinose and Hideo Tamura also discovered, in Lett. Math. Phys. 2004, norm convergence of the unitary product formula to hold for the Dirac and the relativistic SchrOdinger operator with nontrivial scalar potentials.

(2)Problems of path integral and of convergence of integral kernels of the Trotter product: Fujiwara succeeded to improve the error estimate of the stationary phase method of the oscillatory integral in large dimensions, and used it to determine the second term of the semiclassical approximation to Feynman path integral. In this connection, Trotter product formula is thought to give a kind of time-sliced approximation. The good norm-convergence of Trotter product formula might suggest convergence of the integral kernels, as Ichinose and Hideo Tamura anticipated. In fact, we proved it 2004 in two papers in Commn. PDE and J. Reine Angew. Math. (3)Zeno product formula: Ichinose proved 2005 an intermediate result with P.Exner.

Research Products (12 results)

	All	All 2006 2		2004
		All .	lournal	Article
[Journal Article] Exponential product approximation to integral kernel of Schrodinger semigroup and to heat kernel of Dirichlet Laplacian			200	6 ~
[Journal Article] The second term of the semi-classical asymptotic expansion for Feynman path integrals with integrand of polynomial growth			200	6 ~
[Journal Article] Exponential product approximation to integral kernel of Schrodinger semigroup and to heat kernel of Dirichlet Laplacian.			200	6 ~
[Journal Article] The-second term of the semi-classical asymptotic expansion for Feynman path integrals with integrand of polynomial growth.			200	6 ~
[Journal Article] A product formula related to quantum Zeno dynamics			200	5 ~
[Journal Article] A product formula related to quantum Zeno dynamics.			200	5 ~
[Journal Article] Trotter-Kato product formula and fractional powers of self-adjoint generators			200	4 ~
[Journal Article] Note on the norm convergence of the unitary Trotter product formula			200	4 ~
[Journal Article] Sharp error bound on norm convergence of exponential product formula and approximation to kernels of Schrodinger semigroups			200	4 ~
[Journal Article] Hagen Neidhardt and Valentin A. Zagrebnov, Trotter-Kato product formula and fractional powers of self-adjoint generators.			200	4 ~
[Journal Article] Note on the norm conv ergence of the unitary Trotter product formula.			200	4 ~
[Journal Article] Sharp error bound on norm convergence of exponential product formula and approximation to kernels of Schrodinger semigroups.			200	4 ~

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-16340038/163400382006kenkyu_seika_hokoku

Published: 2008-05-26