

Title	Symmetry methods for continuous and discrete systems
Sub Title	
Author	彭, 林玉(Peng, Linyu)
Publisher	福澤基金運営委員会
Publication year	2024
Jtitle	福澤諭吉記念慶應義塾学事振興基金事業報告集 (2023.)
JaLC DOI	
Abstract	This is the last year of a three-year project on the study of symmetries methods for differential and finite difference equations. Symmetries (global or local Lie groups) exist in every corner of nature. During this period, we utilized the modified formal Lagrangian formulation to derive structure-preserving numerical solutions for the viscous Burgers' equation. Additionally, we developed group-invariant solutions for Toda type lattices using a generic symmetry method proposed by the projector leader and Peter Hydon (University of Kent) for semi-discrete equations. A paper on symmetries of a variable-coefficient KdV equation has been published in Chaos, Solitons & Fractals, co-authored with Yaqing Liu (Beijing Information Science and Technology). Two papers on matrix Lie groups and signal processing, as a by-product, were published in IEEE Transactions on Geoscience and Remote Sensing and IEEE Transactions on Aerospace and Electronic Systems. These results were presented at various domestic and international conferences. More details are available below. Furthermore, a joint project with Kenichi Maruno (Waseda University) has been initiated, and two ongoing joint projects related to this research have been established with Rod Halburd (University College London), and with Frank Nijhoff (University of Leeds), Cheng Zhang and Dajun Zhang (Shanghai University), respectively. Finally, it is worth noting that a科学研究費基盤研究(C) project "Symmetry Methods for Discrete Equations and Their Applications" has been adopted (2024-2028).
Notes	申請種類：福澤基金研究補助
Genre	Research Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO12003001-20230001-0022

慶應義塾大学学術情報リポジトリ(KOARA)に掲載されているコンテンツの著作権は、それぞれの著作者、学会または出版社/発行者に帰属し、その権利は著作権法によって保護されています。引用にあたっては、著作権法を遵守してご利用ください。

The copyrights of content available on the Keio Associated Repository of Academic resources (KOARA) belong to the respective authors, academic societies, or publishers/issuers, and these rights are protected by the Japanese Copyright Act. When quoting the content, please follow the Japanese copyright act.

2023年度 福澤基金研究補助研究成果実績報告書

研究代表者	所属	理工学部	職名	准教授	補助額	1,300千円
	氏名	彭 林玉	氏名（英語）	Linyu Peng		
研究課題（日本語）						
Symmetry Methods for Continuous and Discrete Systems						
研究課題（英訳）						
Symmetry Methods for Continuous and Discrete Systems						
研究組織						
氏 名 Name		所属・学科・職名 Affiliation, department, and position				
彭 林玉（Linyu Peng）		理工学部・機械工学科・専任講師（有期）				
1. 研究成果実績の概要						
This is the last year of a three-year project on the study of symmetries methods for differential and finite difference equations. Symmetries (global or local Lie groups) exist in every corner of nature. During this period, we utilized the modified formal Lagrangian formulation to derive structure-preserving numerical solutions for the viscous Burgers’ equation. Additionally, we developed group-invariant solutions for Toda type lattices using a generic symmetry method proposed by the projector leader and Peter Hydon (University of Kent) for semi-discrete equations. A paper on symmetries of a variable-coefficient KdV equation has been published in Chaos, Solitons & Fractals, co-authored with Yaqing Liu (Beijing Information Science and Technology). Two papers on matrix Lie groups and signal processing, as a by-product, were published in IEEE Transactions on Geoscience and Remote Sensing and IEEE Transactions on Aerospace and Electronic Systems. These results were presented at various domestic and international conferences. More details are available below. Furthermore, a joint project with Kenichi Maruno (Waseda University) has been initiated, and two ongoing joint projects related to this research have been established with Rod Halburd (University College London), and with Frank Nijhoff (University of Leeds), Cheng Zhang and Dajun Zhang (Shanghai University), respectively. Finally, it is worth noting that a科学研究費基盤研究(C) project “Symmetry Methods for Discrete Equations and Their Applications” has been adopted (2024-2028).						
2. 研究成果実績の概要（英訳）						
This is the last year of a three-year project on the study of symmetries methods for differential and finite difference equations. Symmetries (global or local Lie groups) exist in every corner of nature. During this period, we utilized the modified formal Lagrangian formulation to derive structure-preserving numerical solutions for the viscous Burgers’ equation. Additionally, we developed group-invariant solutions for Toda type lattices using a generic symmetry method proposed by the projector leader and Peter Hydon (University of Kent) for semi-discrete equations. A paper on symmetries of a variable-coefficient KdV equation has been published in Chaos, Solitons & Fractals, co-authored with Yaqing Liu (Beijing Information Science and Technology). Two papers on matrix Lie groups and signal processing, as a by-product, were published in IEEE Transactions on Geoscience and Remote Sensing and IEEE Transactions on Aerospace and Electronic Systems. These results were presented at various domestic and international conferences. More details are available below. Furthermore, a joint project with Kenichi Maruno (Waseda University) has been initiated, and two ongoing joint projects related to this research have been established with Rod Halburd (University College London), and with Frank Nijhoff (University of Leeds), Cheng Zhang and Dajun Zhang (Shanghai University), respectively. Finally, it is worth noting that a科学研究費基盤研究(C) project “Symmetry Methods for Discrete Equations and Their Applications” has been adopted (2024-2028).						
3. 本研究課題に関する発表						

発表者氏名 (著者・講演者)	発表課題名 (著書名・演題)	発表学術誌名 (著書発行所・講演学会)	学術誌発行 年月 (著書発行 年月・講演 年月)
Yaqing Liu, Linyu Peng	Some novel physical structures of a (2+1)-dimensional variable-coefficient Korteweg-de Vries system	Chaos, Solitons & Fractals	June 2023
Linyu Peng	Symmetry analysis of semi-discrete equations and their conservation laws	6th International Conference on Dynamics, Vibration and Control (ICDVC2022), Shanghai Jiao Tong University, China	April 7-9, 2023 (招待講演)
Mamoru Gunji, Yusuke Ono, Linyu Peng	The influence of accuracy of initial values on the discrete energy in variational integrator	IUTAM Symposium on Nonlinear Dynamics for Design of Mechanical Systems across Different Length/Time Scales (IUTAM2023), Tsukuba, Japan	July 31-August 4, 2023
Hiroaki Yoshimura, Linyu Peng	A discretization of Dirac structures and Lagrange-Dirac dynamical systems	10th International Congress on Industrial and Applied Mathematics (ICIAM2023), Waseda University, Tokyo, Japan	August 20-25, 2023 (招待講演)
Linyu Peng	Noether's conservation laws based on the modified formal variational method	10th International Congress on Industrial and Applied Mathematics (ICIAM2023), Waseda University, Tokyo, Japan	August 20-25, 2023 (招待講演)
Yusuke Ono, Linyu Peng	Applications of Bures-Wasserstein geometry of HPD matrices to signal detection	10th International Congress on Industrial and Applied Mathematics (ICIAM2023), Waseda University, Tokyo, Japan	August 20-25, 2023 (招待講演)
彭林玉	The modified formal variational formulation for general differential equations and applications	持続的環境エネルギー社会共創研究機構 研究所間交流会, 早稲田大学	September 19, 2023 (招待講演)
Linyu Peng	Discrete Lagrangian multiforms on the difference variational bicomplex	BIRS Workshop Lagrangian Multiform Theory and Pluri-Lagrangian Systems, The Institute for Advanced Study in Mathematics, Hangzhou, China	October 22-27, 2023
富田繁, 彭林玉	Toda type latticeの対称性と群不変解	日本応用数理学会第20回研究部会連合発表会, 長岡技術科学大学	March 4-6, 2024
佐藤大輝, 小野悠介, 彭林玉	行列空間上のLq平均を活用した目標信号検出	日本応用数理学会若手の会第9回学生研究発表会, 長岡	March 7, 2024
Jiongyi Wang, Linyu Peng	A finite difference algorithm for mean field games	日本応用数理学会若手の会第9回学生研究発表会, 長岡	March 7, 2024