SGU 関連　研究活動実績（2020 年）

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2020 年度研究実績

１）非平衡熱力学の幾何学と変分的定式化に関連して，時間依存的な非線形かつ非ホロノミック系の枠組みで，開放系外界との物質及び熱移動を伴う単純な非平衡開放系におけるディラック構造を示した．

２）定常的な２相流に関する不可逆過程の熱力学系について，エントロピー最小生成の原理による変分的定式化を行った．

３）接バンドル上に誘導されたディラック構造が存在することを示し，それに関連して接バンドル上のラグランジュ・ディラック力学系の定式化を発展させるとともに，定常な磁場中を動く荷電粒子の定式化に関する応用について考察した．

４）流速ベクトル場に摂動を伴う２次元レイリー・ベナール対流に関する実験を行い，ロープダイナミクスと流体輸送の関連を考察した．

５）Ho:YAG レーザーによって誘起されたキャビテーションクラウドの２次元非定常流れに関する SPH 法による数値解析を行い，クラウドの生成から成長，圧壊と流れ場の関係を明らかにした．

Research Report 2020

1. We have shown that a time-dependent Dirac structure can be constructed in nonequilibrium thermodynamics for the case of simple open systems in the context of time-dependent nonlinear nonholonomic mechanics.

2. We have explored the variational formulation of steady steady-state void fraction through the principle of minimum entropy production.

3. We have investigated the Lagrange-Dirac systems on the tangent bundle in the context of Dirac structures and have examined the formulation of a charged particle moving in a magnetic field.

4. We have made an experimental study for two dimensional Rayleigh-Benard Convection and have studied its chaotic transport with a link to lobe dynamics.

5. We have studied unsteady behaviors of cloud cavitation and have clarified the link with the velocity field using two dimensional numerical analysis by the SPH method.

学術論文

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- Francois Gay-Balmaz and Hiroaki Yoshimura, Dirac structures and variational structures of port-Dirac systems in nonequilibrium thermodynamics, IMA Journal of Mathematical Control and Information. Vol.37, No.4, 50, pp. 2020. https://doi.org/10.1093/imamci/dnaa015.

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- Francois Gay-Balmaz and Hiroaki Yoshimura, From bracket formulations in nonequilibrium thermodynamics of simple systems. Journal of Geometry and Physics, 158, 2020, 103812, 10pp. DOI: 10.1016/j.geomphys.2020.103812

- Takahiro Ushioku, Hiroaki Yoshimura, Numerical study of unsteady behavior of cloud cavitation by smoothed particle hydrodynamics, Proc. ASME 2020 Fluids Engineering Division Summer Meeting, No. 20117, Orlando, USA. FEDSM2020, July, 2020.

- M. Watanabe, Y. Kitamura, N. Hatta, H. Yoshimura, Experimental Analysis of Lagrangian Coherent Structures and Chaotic Mixing in Rayleigh-Benard Convection, Proc. ASME 2020 Fluids Engineering Division Summer Meeting, No. 20116, Orlando, USA. July, 2020.

国際会議発表

- Hiroaki Yoshimura, Dirac structures in nonequilibrium thermodynamics, Keynote Lecture in Joint Structures and Common Foundation of Statistical Physics, Information Geometry and Inference for Learning, Les Houches Summer Week, 26th July to 31st July, 2020 (remote presentation via Zoom).

- Hiroaki Yoshimura, Dirac structures and variational formulations in nonequilibrium thermodynamics, Keynote Lecture in International Workshop on Multiphase Flows: Analysis, Modelling and Numerics Oxford-Waseda in Mathematics, Waseda University, Tokyo, Japan, December 3rd, 2020 (via Zoom Remote).

- Masahito Watanabe and Hiroaki Yoshimura, Lagrangian Coherent Structures in Rayleigh-Benard Convection with Perturbations, International Workshop on Multiphase Flows: Analysis, Modelling and Numerics, Waseda University, Tokyo, Japan, December 3rd, 2020 (via Zoom Remote).

- Takahiro Ushioku and Hiroaki Yoshimura, Multiphase Flow Analysis of Unsteady Behavior of Cloud Cavitation by the Smoothed Particle Hydrodynamics Method, International Workshop on Multiphase Flows: Analysis, Modelling and Numerics, Waseda University, Tokyo, Japan, December 3rd, 2020 (via Zoom Remote).