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研究種目：基盤研究(B) (一般)

研究期間：2014～2018

課題番号：26289131

研究課題名(和文) ネットワークシステムに生じる多様な非線形時空現象の解析・制御・設計

研究課題名(英文) Analysis, control, and design of various spatial-temporal nonlinear phenomena in network systems

研究代表者

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交付決定額(研究期間全体)：(直接経費) 9,500,000円

研究成果の概要(和文)：複数の発振器を相互作用させると各発振器の振動が停止する「振動停止現象」について、安定性解析やパラメータ設計の視点でアプローチし、興味深い知見を得ることができた。さらに、反応拡散系の制御、結合発振器に生じる同期現象を活用したロボット群のフォーメーション制御、直流給電ネットワークの安定化制御についても同様のアプローチで、基盤的で有益な成果を得た。

研究成果の学術的意義や社会的意義

多数のサブシステムが相互に影響を与え合う「ネットワークシステム」に生じる多様な非線形時空現象を、システムの制御や設計を体系的に扱う「システム制御工学」の視点からアプローチすることによって、いかに効率よく解析・制御・設計するか？という問題の解決に貢献する基礎的な知見を得ることができた。この知見をさらに深く・広く展開すれば、応用研究へと進展する可能性がある。

研究成果の概要(英文)：The viewpoints of stability analysis and design in control theory allowed us to obtain the following fundamental and interesting results: a stabilization induced in coupled oscillators (i.e., amplitude death); control of reaction diffusion systems; formation control of mobile robots on the basis of synchronization in coupled oscillators; a stabilization of DC power networks.

研究分野：制御工学・非線形科学

キーワード：結合発振器 ネットワークシステム 時間遅延 反応拡散系 同期現象

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q Keiji Konishi and Naoyuki Hara, Stabilization of a spatially uniform steady state in two systems exhibiting Turing patterns, *Physical Review E*, vol. 97, 2018, 052201-1-6 (1w)
 DOI: doi.org/10.1103/PhysRevE.97.052201

r Hisatoshi Katsumata, Keiji Konishi, and Naoyuki Hara, System identification of propagating wave segments in excitable media and its application to advanced control, *Physical Review E*, vol. 97, 2018, 042210-1-6 (1w)
 DOI: doi.org/10.1103/PhysRevE.97.042210

s Yoshiki Sugitani and Keiji Konishi, Delay-independent design for synchronization in delayed-coupled one-dimensional map networks, *IEICE Trans. Fundamentals*, vol. E101.A, 2018, 1708-1712 (1w)
 DOI: doi.org/10.1587/transfun.E101.A.1708

t Yoshiki Sugitani and Keiji Konishi, Design of coupling parameters for inducing amplitude death in Cartesian product networks of delayed coupled oscillators, *Physical Review E*, vol. 96, 2017, 042216-1-9 (1w)
 DOI: 10.1103/PhysRevE.96.042216

u Hakui Teki, Keiji Konishi, and Naoyuki Hara, Amplitude death in a pair of one-dimensional complex Ginzburg-Landau systems coupled by diffusive connections, *Physical Review E*, vol. 95, 2017, 062220-1-9 (1w)
 DOI: 10.1103/PhysRevE.95.062220

v Hisatoshi Katsumata, Keiji Konishi, and Naoyuki Hara, Proportional-integral control of propagating wave segments in excitable media, *Physical Review E*, vol. 95, 2017, 042216-1-7 (1w)
 DOI: 10.1103/PhysRevE.95.042216

Yoshiki Sugitani, Tomohiko Watanabe, Keiji Konishi, and Naoyuki Hara, Delay-independent design for chaotic synchronization in delay-coupled Bernoulli map networks, *Nonlinear Theory and Its Applications*, IEICE, vol. 8, 2017, 152-172 (1w)

DOI: 10.1587/nolta.8.162

x Tomohiko Watanabe, Yoshiki Sugitani, Keiji Konishi, and Naoyuki Hara, Stability analysis of amplitude death in delay-coupled high-dimensional map networks and their design procedure, *Physica D*, vol. 338, 2017, 26-33 (1w)

DOI: 10.1016/j.physd.2016.07.011

y Yoshiki Sugitani, Keiji Konishi, Naoyuki Hara, Delay- and topology-independent design for inducing amplitude death on networks with time-varying delay connections, *Physical Review E*, vol. 92, 2015, 42928 (1w)

DOI: 10.1103/PhysRevE.92.042928

z Yoshiki Sugitani, Keiji Konishi, Luan Ba Le, Naoyuki Hara, Design of time-delayed connection parameters for inducing amplitude death in high-dimensional oscillator networks, *Chaos*, vol. 24, 2014, 4310524 (1w)

DOI: 10.1063/1.4896318

{ Kazunori Mizobata, Yoshihide Nakaniishi, Keiji Konishi, Naoyuki Hara, Stable periodic orbits in a pair of chaotic oscillators coupled by an extremely weak diffusive connection, *Nonlinear Dynamics*, vol. 79, 2015, 265-273 (1w)

DOI: 10.1007/s11071-014-1662-0

| Keiji Konishi, Yoshiki Sugitani, Naoyuki Hara, Dynamics of dc bus networks and their stabilization by decentralized delayed feedback, *Physical Review E*, vol. 91, 2015, 12911 (1w)

DOI: 10.1103/PhysRevE.91.012911

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