Yoshitaka Saiki

2-1 Naka, Kunitachi, Tokyo 186-8601, Japan
yoshi.saiki@r.hit-u.ac.jp • +81 (42) 580-8538 • http://saiki.hub.hit-u.ac.jp/

WORKING EXPERIENCE

Hitotsubashi University, Graduate School of Business Administration

- Professor — Apr 2020 – Present
- Associate Professor — Apr 2013 – Mar 2020

University of Maryland, Institute for Physical Science and Technology

- Visiting Scholar — Mar 2017 – Mar 2019

Japan Science and Technology Agency (JST), PRESTO

- PRESTO Researcher — Oct 2016 – Mar 2020

Hokkaido University, Graduate School of Science, Department of Mathematics

- Assistant Professor — Sep 2010 – Mar 2013
- Postdoctoral Researcher — Apr 2010 – Aug 2010

Kyoto University, Research Institute for Mathematical Sciences (RIMS)

- JSPS Postdoctoral Researcher — Apr 2007 – Mar 2010

Keio University, Faculty of Science and Technology, Department of Mathematics

- Research Associate (COE Postdoctoral Researcher) — Apr 2006 – Mar 2007

EDUCATION

The University of Tokyo

- Ph.D. in Mathematical Sciences — Apr 2002 – Mar 2006
  - Thesis: Numerical study about a chaotic dynamical system based on unstable periodic orbits
  - Advisers: Prof. Tetsuji Tokihiro, Prof. Junkichi Satsuma, Prof. Michio Yamada
  - Focus: Dynamical system, Computation, Periodic orbits.
- M.S. in Mathematical Sciences — Apr 2000 – Mar 2002
  - Thesis: Construction and Applications of Spatio-temporal Continuous Wavelet Transforms accompanied with Scale invariances of Differential Equations
  - Adviser: Prof. Michio Yamada
  - Focus: Wavelet analysis, Computation.
- Bachelor of Liberal Arts — Apr 1996 – Mar 2000

AWARDS & SCHOLARSHIPS

- JSPS postdoctoral Fellow — Apr 2007 – Mar 2010
- FAPESP Fellow — Jul 2006 – Aug 2006

GRANTS

Principal Investigator

- JSPS Establishing data descriptive science and its cross-disciplinary applications “Data-driven modeling of ordinary differential equations using regression” — 2023 – 2025
  ¥4,680,000 (Direct Cost: ¥3,600,000, Indirect Cost: 1,080,000)
- JSPS Bilateral Open Partnership Joint Research Projects “Dynamical system and reservoir computing” — 2022 – 2024
  ¥3,800,000
- Grant-in-Aid for Challenging Exploratory Research “Expediting and Elaborating Business Forecast Using Machine Learning” — 2021 – 2024
  ¥6,240,000 (Direct Cost: ¥4,800,000 Indirect Cost: ¥1,440,000)
- Fostering Joint International Research (B) “Intermittency due to hetero-chaotic property and its inference” — 2019 – 2024
  ¥18,070,000 (Direct Cost: ¥13,900,000 Indirect Cost: ¥4,170,000)
- Grant-in-Aid for Scientific Research (C) “Fast Computation of Birkhoff Average along a Quasi-periodic Orbit and its Applications” — 2017 – 2022
  ¥4,420,000 (Direct Cost: ¥3,400,000 Indirect Cost: ¥1,020,000)
- JST PRESTO “Construction of a synchronization theory based on hetero-dimensional cycle: Toward an understanding of complex phenomena” — 2016 – 2019
  ¥24,609,000 (Direct Cost: ¥18,930,000 Indirect Cost: ¥5,679,000)

- Grant-in-Aid for Challenging Exploratory Research "Mathematical characterization of chaotic itinerancy" 2014 – 2016
  ¥3,770,000 (Direct Cost: ¥2,900,000 Indirect Cost: ¥870,000)
- Grant-in-Aid for Young Scientists (B) "Analysis of non-hyperbolic systems through unstable periodic orbits" 2011 – 2013
  ¥4,290,000 (Direct Cost: ¥3,300,000 Indirect Cost: ¥990,000)
- Grant-in-Aid for JSPS Fellows "Large-scale numerical calculation of chaotic systems through unstable periodic orbits and its applications" 2007 – 2010
  ¥3,300,000 (Direct Cost: ¥3,300,000)

Co-Investigator

- Grant-in-Aid for Scientific Research (C) "Data analysis and computation of regional business cycles" 2019 – 2022
- Grant-in-Aid for Challenging Exploratory Research "Construction of mathematical models for long-term forecast of atmospheric variation by climate time-series" 2013 – 2015
- Grant-in-Aid for Challenging Exploratory Research "Understanding Synchronization of Business Cycles Using Wavelet Analysis and Nonlinear Coupled Oscillator Models" 2012 – 2014

PROFESSIONAL AFFILIATIONS & ACTIVITIES

The Mathematical Society of Japan

- Member 2009 – Present
- Councillor 2010
- Delegate 2011
- Editor (Sugaku Tushin) 2010 – 2011
- Editor (Sugaku) 2022 – Present

The Japan Society for Industrial and Applied Mathematics

- Member 2006 – Present
- Editor 2014 – 2015

The Japanese Society for Mathematical Economics

- Member 2006 – Present
- Councillor 2017 – 2021

Japan Society of Monetary Economics

- Member 2013 – Present

PUBLICATIONS

JOURNALS

Peer reviewed journal papers

[30] Y. Saiki, H. Takahasi and J. A. Yorke, "Hausdorff dimension of Cantor intersections and robust heterodimensional cycles for heterochaos horseshoe maps," *SIAM Journal on Applied Dynamical Systems* 22 (3), 1852-1876, 2023 (published: July 28).

[29] Y. Saiki, H. Takahasi and J. A. Yorke, "The twisted baker map," *Nonlinearity* 36, 1776-1788, 2023 (published Feb 7).

[28] N. Tsutsumi, K. Nakai and Y. Saiki, "Constructing differential equations using only a scalar time-series about continuous time chaotic dynamics," *Chaos* 32 (9), 091101, 2022 (published online Sep 12).

[27] M. Muto, T. Onozaki and Y. Saiki, "Regional Synchronization during Economic Contraction: The Case of the U.S. and Japan," *Applied Economics*, 2022 (published online Sep 5).

[26] M. U. Kobayashi, K. Nakai, Y. Saiki and N. Tsutsumi, "Dynamical system analysis of a data-driven model constructed by reservoir computing," *Physical Review E*, 104 (4), 044215:1-7, 2021 (published online Oct 28).

[25] Y. Saiki, H. Takahasi and J. A. Yorke, "Piecewise-linear maps with heterogeneous chaos," *Nonlinearity* 34 (8) 5744-5761, 2021 (published July 13).

[24] K. Nakai and Y. Saiki, "Machine-learning construction of a model for a macroscopic fluid variable using the delay-coordinate of a scalar observable," *Discrete and Continuous Dynamical Systems Series S* 14 (3), 1079-1092, 2021 (published March).

[23] S. Das, Y. Saiki, E. Sander and J. A. Yorke, "Solving the Babylonian Problem of quasiperiodic rotation rates," *Discrete and Continuous Dynamical Systems Series S* 12 (8), 2279-2305, 2019 (published online Jan 6).

[22] Y. Saiki and J. A. Yorke, "Quasiperiodic orbits in Siegel disks/balls and the Babylonian problem," *Regular and Chaotic Dynamics* 23 (6), 735-750, 2018 (published Nov 29).

[21] Y. Saiki, M. F. Sanjuán and J. A. Yorke, "Low-dimensional paradigms for high-dimensional hetero-chaos," *Chaos* 28 (10), 103110:1-7, 2018 (published online Oct 18).

[20] K. Nakai and Y. Saiki, "Machine-learning inference of fluid variables from data using reservoir computing," *Physical Review E* 98 (2), 023111:1-6, 2018 (published online Aug 31).

[19] N. Nakano, M. Inatsu, S. Kusuoka and Y. Saiki, "Empirical evaluated SDE modelling for dimensionality reduction systems and its predictability estimates," *Japan Journal of Industrial and Applied Mathematics* 35 (2), 553-589, 2018 (published online Feb 23/ published July).

[18] K. Esashi, T. Onozaki, Y. Saiki and Y. Sato, "Intermittent transition between synchronization and desynchronization in multi-regional business cycles," *Structural Change and Economic Dynamics* 44, 68-76, 2018 (published March 17).

[17] S. Das, Y. Saiki, E. Sander and J. A. Yorke, "Quantitative Quasiperiodicity," *Nonlinearity* 30 (11), 4111-4140, 2017 (published October 11).

[16] M. U. Kobayashi and Y. Saiki, "Network analyses of chaotic systems through unstable periodic orbits," *Chaos* 27 (8), 081103:1-6, 2017 (published August 23).

[15] Y. Saiki, E. Sander and J. A. Yorke, "Generalized Lorenz Equations on a Three-Sphere," *European Physical Journal Special Topics* 226 (9), 1751-1764, 2017 (published June 21).

[14] S. Das, C. B. Dock, Y. Saiki, M. Salgado-Flores, E. Sander, J. Wu and J. A. Yorke, "Measuring quasiperiodicity," *Europhysics Letters* 114 (4), 40005:1-6, 2016.

[13] Y. Saiki, M. Yamada, A. Chian, R. Miranda and E. Rempel, "Reconstruction of chaotic saddles by classification of unstable periodic orbits: Kuramoto-Sivashinsky equation," *Chaos* 25 (10), 103123:1-6, 2015.

[12] M. U. Kobayashi and Y. Saiki, "Manifold structures of unstable periodic orbits and the appearance of periodic windows in chaotic systems," *Physical Review E* 89 (2), 022904:1-6, 2014.

[11] Y. Saiki and K. Ishiyama, "Recognition of transition patterns in a business cycle model using unstable periodic orbits," *International Journal of Bifurcation and Chaos* 21 (4), 1203-1214, 2011.

[10] Y. Saiki, A. Chian and H. Yoshida, "Economic intermittency in a two-country model of business cycles coupled by investment," *Chaos, Solitons and Fractals* 44 (6), 418-428, 2011.

[9] Y. Saiki and M. U. Kobayashi, "Numerical identification of nonhyperbolicity of the Lorenz system through Lyapunov vectors," *JSIAM Letters* 2, 107-110, 2010.

[8] A. Chian, R. Miranda, E. Rempel, Y. Saiki and M. Yamada, "Amplitude-Phase Synchronization at the Onset of Permanent Spatiotemporal Chaos," *Physical Review Letters* 104 (25), 254102:1-4, 2010.

[7] Y. Saiki and M. Yamada, "Reply to "Comment on 'Time averaged properties of unstable periodic orbits and chaotic orbits in ordinary differential equation systems'"," *Physical Review E* 81 (1), 019202:1-2, 2010.

[6] Y. Saiki and M. Yamada, "Time averaged properties of unstable periodic orbits and chaotic orbits in ordinary differential equation systems," *Physical Review E* 79 (1),015201:1-4, 2009.

[5] Y. Saiki and M. Yamada, "Time averaged properties along unstable periodic orbits and chaotic orbits in two map systems," *Nonlinear Processes in Geophysics* 15, 675-680, 2008.

[4] M. Yamada and Y. Saiki, "Chaotic properties of a fully developed model turbulence," *Nonlinear Processes in Geophysics* 14, 631-640, 2007.

[3] Y. Saiki, "Numerical detection of unstable periodic orbits in continuous-time dynamical systems with chaotic behaviors," *Nonlinear Processes in Geophysics* 14, 615-620, 2007.

[2] K. Ishiyama and Y. Saiki, "Unstable Periodic Orbits embedded in a Chaotic Economic Dynamics Model: A Typical Structure of a Generalized Goodwin Model," *Applied Economics Letters* 12 (12), 749-753, 2005.

[1] K. Ishiyama and Y. Saiki, “Unstable periodic orbits and chaotic economic growth,” *Chaos, Solitons and Fractals* 26 (1), 33-42, 2005.

Invited review papers

[2] Y. Saiki, “Unstable periodic orbits embedded in ordinary differential equation systems : properties and numerical detection,” *Keio journal of economics* 101(3), 93-109, 2008 (in Japanese).

[1] Y. Saiki, “Extraction unstable cycles from ordinary differential equation systems,” *Seminar on Mathematical Sciences Keio University* 37, 19-34, 2008.

Proceeding papers

[5] N. Nakano, M. Inatsu, S. Kusuoka, Y. Saiki, “Time-series analysis and predictability estimates by empirical SDE modelling,” *Proceedings of the ISCIE International Symposium on Stochastic Systems Theory and its Applications*, 332-339, 2016.

[4] S. Das, Y. Saiki, E. Sander and J. A. Yorke, “Quasiperiodicity: Rotation Numbers,” Chapter 7, *The Foundations of Chaos Revisited: From Poincare to Recent Advancements (Understanding Complex Systems)*, Springer, 103-117, 2016.

[3] Y. Saiki, “Unstable periodic orbits in a nonhyperbolic system: Cycle expansion for the Henon map,” *Reports of RIAM Symposium* 25AO-S2, 91-100, 2014 (in Japanese).

[2] Y. Saiki and M. Yamada, “Time Averaged Properties Along Unstable Periodic Orbits of the Kuramoto-Sivashinsky Equation,” *Nankai Series in Pure, Applied Mathematics and Theoretical Physics* Volume 10, World Scientific, 145-154, 2013.

[1] K. Ishiyama and Y. Saiki, “Unstable Periodic orbits and chaotic transitions among growth patterns of an economy,” *the Practical Fruits of Econophysics: Proceedings of the Third Nikkei Econophysics Symposium*, Springer (H.Takayasu Ed.), 339-343, 2006.

Preprints/Papers in preparation

[4] M. Inubushi, Y. Saiki, M. U. Kobayashi, S. Goto, Characterizing Data Assimilation in Navier-Stokes Turbulence with Transverse Lyapunov Exponents, *submitted*.

[3] N. Tsutsumi, K. Nakai and Y. Saiki, Constructing low-dimensional ordinary differential equations from chaotic time series of high/infinite-dimensional systems using radial function-based regression, *submitted*.

[2] T. Suematsu, K. Nakai, T. Yoneda, D. Takasuka, T. Jinno, Y. Saiki and H. Miura, “Machine learning prediction of the MJO extends beyond one month,” *submitted*.

[1] M. Muto and Y. Saiki, “Synchronization of US dollar and Euro, US dollar and Japanese yen based on purchasing power parity: Synchronization analysis using Hilbert transform,” *submitted*.