

Yutaka Hori

Affiliation

Department of Applied Physics and Physico-informatics,
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Education

- March 2013 **Ph.D.** Department of Information Physics and Computing, Graduate School of Information Science and Technology, The University of Tokyo
Advisor: Prof. Shinji Hara
- March 2010 **M.S.** Department of Information Physics and Computing, Graduate School of Information Science and Technology, The University of Tokyo
Advisor: Prof. Shinji Hara
- March 2008 **B.E.** Department of Mathematical Engineering and Information Physics, Faculty of Engineering, The University of Tokyo
Advisor: Prof. Shigeki Sagayama

Academic Positions Held

- Apr. 2021 – present **Associate Professor**
Department of Applied Physics and Physico-Informatics, Keio University, Japan
- Apr. 2019 – Mar. 2021 **Senior Assistant Professor (tenured)**
Department of Applied Physics and Physico-Informatics, Keio University, Japan
- Apr. 2017 – Mar. 2019 **Visiting Scientist**
Laboratory for Integrative Genomics, RIKEN Center for Integrative Medical Sciences, Japan
- Apr. 2016 – Mar. 2019 **Assistant Professor (tenure-track)**
Department of Applied Physics and Physico-Informatics, Keio University, Japan
- Sept. 2013 – Mar. 2016 **Postdoctoral Scholar**

Department of Computing and Mathematical Sciences, California Institute of Technology, USA

Advisor: Prof. Richard M. Murray

Apr. 2013 – Aug. 2013 **Project Researcher (Postdoctoral Scholar)**

Department of Information Physics and Computing, The University of Tokyo

Advisor: Prof. Shinji Hara

Oct. 2010 – July 2011 **Visiting Student**

Department of Mechanical Engineering, University of California, Santa Barbara, USA

Advisor: Prof. Mustafa Khammash

Research Interests

My research interests are in **feedback control theory**, **mathematical optimization** and their application to **synthetic biology**. My research works are particularly focused on streamlining the process of biocircuit synthesis from systems and control engineering perspectives. To this goal, I combine tools in feedback control theory and mathematical optimization to develop system theoretic model identification, analysis and design methodologies. My research work also includes development of system-oriented experimental platforms such as combined computational and microfluidic devices that can supplement model prediction with theoretically meaningful data.

Conference/Journal Paper Awards

Oct. 2015 **Best Paper Award (Takeda Award)** from SICE for the paper T. Nakamura, Y. Hori and S. Hara, *SICE JCMSI*, vol. 7, No. 3, pp. 133–140, 2014.

Mar. 2014 **Conference Award** at the 13th SICE Conference on Control Systems

May 2011 **Finalist of Best Paper Award** at 2011 Asian Control Conference

Mar. 2011 **Research Encouragement Award** from SICE control division

Sept. 2010 **Finalist of Best Student Paper Award** at 2010 IEEE Multi-Conference on Systems and Control

Aug. 2009 **Annual Conference Young Author's Award** at ICROS-SICE International Joint Conference in 2009

Mar. 2009 **Conference Award** at the 9th SICE Conference on Control Systems

List of Publications

Journal Papers

1. K. Kambe, Y. Hirokawa, A. Koshi, **Y. Hori**, “A parametric logistic equation with light flux and medium concentration for cultivation planning of microalgae,” *Journal of the Royal Society Inter-*

- face*, vol. 19, No. 19, 20220166, 2022.
2. S. Hara, T. Iwasaki, **Y. Hori**, “Instability Margin Analysis for Parametrized LTI Systems with Application to Repressilator,” *Automatica*, vol. 136, no. 2, 110047, 2022.
 3. T. Kotsuka, **Y. Hori**, “Spatial Frequency based Characterization of Disturbance Rejection in Molecular Communication Systems,” *IEEE Transactions on Molecular, Biological, and Multi-Scale Communications*, vol.8, no. 1, pp.36–43, 2022.
 4. N. Takeuchi, S. Nakajima, R. Kawano, **Y. Hori** and H. Onoe, “Microfiber-shaped programmable materials with stimuli-responsive hydrogel,” *Soft Robotics*, 2020.
 5. R. Suzuki, T. Emura, Y. Tokura, N. Kawamura, **Y. Hori**, “A Quartz Crystal Microbalance based Portable Gas Sensing Platform for On-demand Human Breath Monitoring,” *IEEE Access*, vol. 8, pp. 146166–146171, 2020.
 6. T. Matsunaga, R. Uemura and **Y. Hori**, “Finite-time Stability Analysis for Resource Limited Chemical Reactions,” *IEEE Control Systems Letters*, vol. 5, No. 3, pp. 815–820, 2020.
 7. S. Hara, T. Iwasaki and **Y. Hori**, “Robust Stability Analysis for LTI Systems with Generalized Frequency Variables and Its Application to Gene Regulatory Networks,” *Automatica*, vol. 105, No. 7, pp. 96–106, 2019.
 8. **Y. Hori** and H. Miyazako, “Analysing diffusion and flow-driven instability using semidefinite programming,” *Journal of the Royal Society Interface*, vol. 16, No. 150, 20180586, 2019.
 9. Y. Sakurai and **Y. Hori**, “Bounding Transient Moments of Stochastic Chemical Reactions,” *IEEE Control Systems Letters*, vol 3, No. 2, (special issue on Control and Network Theory for Biological Systems), pp. 290–295, 2019.
 10. Y. Sakurai and **Y. Hori**, “Optimization-based Synthesis of Stochastic Biocircuits with Statistical Specifications,” *Journal of the Royal Society Interface*, vol. 15, No. 138, 20170709, 2018.
 11. **Y. Hori**, C. Katak, R. M. Murray and A. R. Abate, “Cell-free Extract based Optimization of Biomolecular Circuits with Droplet Microfluidics,” *Lab on a Chip*, vol. 17, pp. 3037-3042, 2017 [Selected for the front cover of the journal]
 12. V. Hsiao, **Y. Hori**, P. W. K. Rothmund and R. M. Murray, “A Population-based Temporal Logic Gate for Timing and Recording Chemical Events,” *Molecular Systems Biology*, vol. 12, No. 5, 869, 2016.
 13. **Y. Hori**, H. Miyazako, S. Kumagai and S. Hara, “Coordinated Spatial Pattern Formation in Biomolecular Communication Networks,” *IEEE Transactions on Molecular, Biological, and Multi-Scale Communications*, vol. 1, No. 2, pp.111–121, 2015.
 14. H. Niederholtmeyer*, Z. Z. Sun*, **Y. Hori**, E. Yeung, A. Verpoorte, R. M. Murray and S. J. Maerkl, “Rapid Cell-free Forward Engineering of Novel Genetic Ring Oscillators,” *eLife*, vol. 4, e09771, 2015.

15. Y. Wang, **Y. Hori**, S. Hara and F. J. Doyle III, “Collective Oscillation Period of Inter-Coupled Biological Negative Cyclic Feedback Oscillators,” *IEEE Transactions on Automatic Control*, vol. 60, No. 5, pp.1392–1397, 2015.
16. M. Takada, **Y. Hori** and S. Hara, “Comments and Corrections on Stability of Genetic Regulatory Networks With Time Delay,” *IEEE Transactions on Circuits and Systems I*, vol. 61, No. 9, pp. 2771–2774, 2014.
17. T. Nakamura, **Y. Hori** and S. Hara, “Hierarchical Modeling and Local Stability Analysis for Repressilators Coupled by Quorum Sensing,” *SICE Journal of Control, Measurement, and System Integration*, vol. 7, No. 3, pp. 133–140, 2014. [Best Paper Award (Takeda Award)]
18. Y. Wang, **Y. Hori**, S. Hara and F. J. Doyle III, “Intercellular delay regulates the collective period of repressively coupled gene regulatory oscillator networks” *IEEE Transactions on Automatic Control*, vol. 59, No. 1, pp. 211–216, 2014.
19. **Y. Hori**, M. Takada and S. Hara, “Biochemical Oscillations in Delayed Negative Cyclic Feedback: Existence and Profiles” *Automatica*, vol. 49, No. 9, pp. 2581–2590, 2013.
20. **Y. Hori**, T.-H. Kim and S. Hara, “Existence Criteria of Periodic Oscillations in Cyclic Gene Regulatory Networks,” *Automatica*, vol. 47, No. 6 (special issue on Systems Biology), pp. 1203–1209, 2011.
21. T.-H. Kim, **Y. Hori** and S. Hara, “Robust Stability Analysis of Gene-protein Regulatory Networks with Cyclic Activation repression Interconnections,” *Systems and Control Letters*, vol. 60, No. 6, pp. 373–382, 2011.
22. T.-H. Kim, S. Hara and **Y. Hori**, “Cooperative Control of Multi-agent Dynamical Systems in Target-enclosing Operations using Cyclic Pursuit Strategy,” *International Journal of Control*, vol. 83, No. 10, pp. 2040–2052, 2010.
23. S. Murata, A. Kuzuya, K. Fujiwara, J. Taira, I. Kawamata, Y. Sato, M. Takinoue, S. M. Nomura, A. Kakugo, **Y. Hori**, K. Abe, “Online Biomolecular Design Competition Across University Boundaries,” *Journal of JSEE*, 2021 (accepted).
24. **Y. Hori**, “A Control Engineering Approach to Designing and Building Genetic Circuits,” *Systems, Control and Information*, Vol. 61, No. 5, pp. 194–199, 2017 (in Japanese).
25. H. Miyazako, **Y. Hori** and S. Hara, “Analysis of Turing Instability in Reaction-Diffusion Systems Using a Single Diffuser,” *Transactions of the Society of Instrument and Control Engineers*, Vol. 49, No. 12, pp. 1164–1171, 2012 (in Japanese).
26. S. Osawa, **Y. Hori** and S. Hara, “Robust Stability Analysis for Cyclic Gene Regulatory Networks,” *Transactions of the Society of Instrument and Control Engineers*, Vol. 48, No. 6, pp. 318–325, 2012 (in Japanese).

27. **Y. Hori** and S. Hara, “Oscillation Profile Analysis for Cyclic Gene Regulatory Networks,” *Transactions of the Society of Instrument and Control Engineers*, Vol. 48, No. 4, pp. 241–247, 2012 (in Japanese).
28. S. Hara, **Y. Hori** and T.-H. Kim, “Cyclic Pursuit Based Formation Control for Cooperative Target-enclosing,” *Transactions of the Society of Instrument and Control Engineers*, Vol. 45, No. 3, pp. 160–167, 2009 (in Japanese).

Review Paper

1. Y. Hori, “Modeling and Analysis of Stochastic Reaction Kinetics in Biomolecular Systems,” *New Generation Computing*, vol. 38, pp. 367–377 .2020.

Refereed Conference Papers

1. T. Kotsuka, **Y. Hori**, “Frequency response of diffusion-based molecular communication channels in bounded environment,” *Proceedings of European Control Conference*, 2022 (accepted).
2. S. Hara, T. Iwasaki, **Y. Hori**, “Robust Instability Radius for Multi-agent Dynamical Systems with Cyclic Structure,” *Proceedings of SICE International Symposium on Control Systems*, 2021.
3. S. Hara, T. Iwasaki and **Y. Hori**, “Robust Instability Analysis with Application to Neuronal Dynamics,” *Proceedings of the 59th IEEE Conference on Decision and Control*, pp. 6156-6161, 2020.
4. N. Takeuchi, S. Nakajima, R. Kawano, Y. Hori, H. Onoe , “Locally Bendable Stimuli-Responsive Hydrogel Actuator with Axially Patterned Functional Materials,” *IEEE International Conference on Micro Electro Mechanical Systems (MEMS)*, 2019.
5. T. Kotsuka and **Y. Hori** “Analysing disturbance response of cell-to-cell communication systems based on spatial frequency decomposition,” *Proceedings of IFAC Conference on Foundations of Systems Biology in Engineering*, vol. 52, No. 26, pp. 65–69, 2019.
6. **Y. Hori** and H. Miyazako “Semidefinite programming for Turing instability analysis in molecular communication networks,” *Proceedings of IEEE Conference on Decision and Control*, pp. 1874–1880, 2019.
7. A. Wakamei and **Y. Hori**, “A microfluidic actuator for dynamic control of chemical reactions,” *Proceedings of SICE Annual Conference*, pp. 1767–1769, 2018.
8. T. Yamada, Y. Hori, S. Suzuki, S. Kawasaki, N. Hiroi, H. Saito and A. Funahashi, “Mathematical modeling identifies the conditions required for RNA-based oscillator,” *Proceedings of SICE Annual Conference*, pp.1574–1578, 2018.
9. Y. Sakurai and **Y. Hori**, “A Convex Approach to Steady State Moment Analysis for Stochastic Chemical Reactions,” *Proceedings of IEEE Conference on Decision and Control*, pp. 1206–1211, 2017.

10. T. Uchiyama, **Y. Hori**, K. Suzuki, “Estimation of tibialis anterior muscle stiffness during the swing phase of walking with various footwear,” *Proceedings of IEEE Engineering in Medicine and Biology Society*, pp. 4131–4134, 2017.
11. **Y. Hori** and R. M. Murray, “Engineering Principles of Synthetic Biochemical Oscillators with Negative Cyclic Feedback,” *Proceedings of IEEE Conference on Decision and Control*, pp. 584–589, 2015.
12. **Y. Hori** and R. M. Murray, “A State-space Realization Approach to Set Identification of Biochemical Kinetic Parameters,” *Proceedings of European Control Conference*, pp. 2285–2290, 2015.
13. **Y. Hori**, S. Kumagai and S. Hara, “Network Structure for Turing Instabilizability in Reaction-Diffusion Systems with One Diffuser: A Case Study for Three-gene Networks,” *Proceedings of SICE Annual Conference*, pp. 892–895, 2014.
14. H. Miyazako, **Y. Hori** and S. Hara, “Turing Instability in Reaction-Diffusion Systems with a Single Diffuser: Characterization Based on Root Locus,” *Proceedings of IEEE Conference on Decision and Control*, pp. 2671–2676, 2013.
15. **Y. Hori**, M. H. Khammash and S. Hara, “Efficient Parameter Identification for Stochastic Biochemical Networks Using a Reduced-order Realization,” *Proceedings of European Control Conference*, pp.4154–4159, 2013.
16. **Y. Hori** and S. Hara, “Noise-Induced Spatial Pattern Formation in Stochastic Reaction-Diffusion Systems,” *Proceedings of IEEE Conference on Decision and Control*, pp. 1053–1058, 2012.
17. Y. Wang, **Y. Hori**, S. Hara and F. J. Doyle III, “The Collective Oscillation Period of Inter-coupled Goodwin Oscillators,” *Proceedings of IEEE Conference on Decision and Control*, pp. 1627–1632, 2012.
18. T. Nakamura, S. Hara and **Y. Hori**, “Local Stability Analysis for a Class of Quorum-Sensing Networks with Cyclic Gene Regulatory Networks,” *Proceedings of the SICE Annual Conference*, pp. 2111–2116, 2011.
19. **Y. Hori** and S. Hara, “Time Delay Effects on Oscillation Profiles in Cyclic Gene Regulatory Networks: Harmonic Balance Approach,” *Proceedings of American Control Conference*, pp. 2891–2896, 2011.
20. S. Osawa, **Y. Hori** and S. Hara, “Robust Stability Analysis for Cyclic Gene Regulatory Networks with Uncertainty,” *Proceedings of Asian Control Conference*, pp. 869–874, 2011. [*Finalist of Best Paper Award*]
21. **Y. Hori** and S. Hara, “Oscillation Pattern Analysis for Gene Regulatory Networks with Negative Cyclic Feedback,” *Proceedings of IEEE Conference on Decision and Control*, pp. 5798–5803, 2010.
22. **Y. Hori**, S. Hara and T.-H. Kim, “Periodic Oscillations in Cyclic Repressor Networks: Analytic Existence Criteria with Biological Insight,” *Proceedings of IEEE Multi-conference on Systems and Control*, pp.824–829, 2010. [*Finalist of Best Student Paper Award*]

23. M. Takada, **Y. Hori** and S. Hara, “Existence Conditions for Periodic Oscillations in Cyclic Gene Regulatory Networks with Time Delay,” *Proceedings of IEEE Multi-conference on Systems and Control*, pp.830–835, 2010.
24. **Y. Hori**, T.-H. Kim and S. Hara, “Graphical and Analytic Criteria for the Existence of Protein Level Oscillations in Cyclic Gene Regulatory Networks,” *Proceedings of IEEE Conference on Decision and Control*, pp. 3521–3526, 2009.
25. **Y. Hori**, T.-H. Kim and S. Hara, “Robust Stability Analysis of Gene-Protein Regulatory Networks with Cyclic Activation-Inhibition interconnections,” *Proceedings of Asian Control Conference*, pp.1334–1339, 2009.
26. **Y. Hori**, A. Takabe and S. Hara, “On the Existence of Oscillatory Behavior in Gene Regulatory Networks with Cyclic Interconnections,” *Proceedings of ICROS-SICE International Joint Conference*, pp.2525–2530 2009. [*Annual Conference Young Author’s Award*]
27. S. Hara, T.-H. Kim and **Y. Hori**, “Distributed Formation Control for Target-Enclosing Operations Based on a Cyclic Pursuit Strategy,” *Proceedings of International Federation of Automatic Control Congress World Congress*, pp. 6602–6607, 2008.

Dissertations

1. Ph.D. thesis: “Control Theoretic Approaches to Analysis and Identification of Biochemical Networks,” The University of Tokyo, Mar. 2013 (advisor: Prof. Shinji Hara).
2. Master’s thesis: “Robust Stability Criteria and Oscillatory Behavior Analysis for Cyclic Gene Regulatory Networks,” The University of Tokyo, Mar. 2010 (advisor: Prof. Shinji Hara).
3. Bachelor’s thesis: “A Study on Lossless Coding of Logarithmic Companded Voice Signals,” The University of Tokyo, Mar. 2008 (in Japanese) (advisor: Prof. Shigeki Sagayama and Prof. Nobutaka Ono).

Professional Service

Membership

- Member of IEEE (The Institute of Electrical and Electronics Engineers)
 - Member of IEEE Control Systems Society (CSS)
 - Member of IEEE CSS Systems Biology Technical Committee
 - Member of IEEE Life Sciences Community
- Member of SICE (The Society of Instrument and Control Engineering)
- Member of ISCIE (The Institute of Systems, Control and Information Engineers)

Technical Committee

- **Member**, Technical Committee on Biosystems and Bioprocesses, International Federation of Automatic Control (IFAC)
- **Member**, Technical Committee on Systems Biology, IEEE Control Systems Society (IEEE CSS)

Editorial experience

- **Guest Editor**, Advanced Robotics
- **Associate Editor**, Conference Editorial Board of IEEE Control Systems Society

Conference organizer

- **Track Chair**, SICE 2022 (2022)
- **Technical Committee Member**, ACM NanoCom 2022
- **Track Chair**, SICE 2021 (2021)
- **Program Committee Member**, SICE 2021 (2021)
- **General Chair**, the 4th Annual Meeting of Molecular Robotics (2020)
- **International Program Committee Member**, the 8th IFAC Conference on Foundations of Systems Biology in Engineering (2019)
- **Finance Chair**, the 2nd Annual Meeting of Molecular Robotics (2018)
- **Program Committee Member**, 2018 SICE Annual Conference
- **Session organizer** at IEEE CDC, SICE Annual Conference, SICE MSCS and other conferences.