Masaaki KANNO, Ph.D.

Associate Professor
Program: Electrical and Information Engineering
Area: Information Engineering
Undergraduate: Dept. of Engineering

Professional Expertise

His professional expertise is in linear control theory. In particular, current main research topics are the development of parametric optimization methods based on algebraic approaches to control problems, the characterization of performance limitations, and the development of guaranteed accuracy computation algorithms. The aim of such researches is to establish new methodologies for understanding intrinsic limitations in control and further providing efficient approaches to achieve the very optimal design.

Research Fields of Interest

Parametric Optimization Methods Based on Algebraic Approaches

- Parametric polynomial spectral factorization using Gröbner basis theory and the Sum of Roots
- Solution of algebraic Riccati equations with multiple real parameters
- Symbolic-numeric hybrid parameter optimization

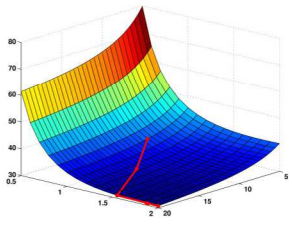
Characterization of Performance Limitations

- H_2 tracking/regulation performance limitations
- Characterization of performance limitation in H_∞ loop-shaping based on the finite-frequency phase/gain property
- Pursuit of performance limit characterization suited for algebraic methods

Guaranteed Accuracy Computation

- Algorithm development for L_∞-norm computation, H_2/H_∞ performance limits
- Symbolic-numeric hybrid approach for validated numerical computation

When a plant contains real parameters that can be tuned, one typically has to employ a brute-force/heuristic approach to find the best parameter values that achieves the best performance. The algebraic approach developed by the group of Dr Kanno allows one to express the optimal cost algebraically with respect to parameters and thus to pursue a systematic way to find the very optimum.



Education

2004: Ph.D. in Information Engineering, University of Cambridge, UK
2000: M.Phil. in Control Engineering, University of Sussex, UK
1993: Master's degree in Information Engineering, University of Tokyo, Japan
1991: Bachelor's degree in Mechanical Engineering, University of Tokyo, Japan

Professional Societies and Activities

1. Member of the Society of Instrument and Control Engineers (SICE)
2. Member of The Japan Society of Mechanical Engineers (JSME)
3. Assistant Representative of the Steering Committee of the Japan Society for Symbolic and Algebraic Computation (JSSAC) Special Interest Group on Theory (2008–)

Awards

1. Society of Instrument and Control Engineers 2008 Award for Best Paper
2. Society of Instrument and Control Engineers 2007 Award for Outstanding Book

Major Publications

Papers

[1] "Plant/Controller Design Integration for H_2 Control Based on Symbolic-numeric Hybrid Optimization", *Communications in Information and Systems*, vol. 11, no. 3, pp. 281-306, 2011.

[2] "Computer Algebra for Guaranteed Accuracy. How Does It Help?", *Japan Journal of Industrial and Applied Mathematics*, vol. 26, nos. 2-3, pp. 517-530, 2010.

[3] "Algebraic Approach to Discrete-time Polynomial Spectral Factorization", *Journal of Math-for-Industry*, vol. 1, pp. 57-68, 2009.

[4] "Parametric Polynomial Spectral Factorization Using the Sum of Roots and Its Application to a Control Design Problem", *Journal of Symbolic Computation*, vol. 44, no. 7, pp. 703-725, 2009.

[5] "Characterization of Easily Controllable Discrete-time Plants Based on Finite Frequency Phase/Gain Property (in Japanese)", *Transactions of the Institute of Systems, Control and Information Engineers*, vol. 21, no. 7, pp. 234-236, 2008.

[6] "Sum of Roots Characterization for H_2 Control Performance Limitations", *SICE Journal of Control, Measurement, and System Integration*, vol. 1, no. 1, pp. 58-65, 2008.

[7] "Guaranteed Accuracy Computation for Discrete-time H_2 Control (in Japanese)", *Transactions of the Institute of Systems, Control and Information Engineers*, vol. 20, no. 11, pp. 451-453, 2007.

[8] "Characterization of Easily Controllable Continuous-time Plants Based on Finite Frequency Phase/Gain Property", *Transactions of the Society of Instrument and Control Engineers*, vol. 43, no. 10, pp. 855-862, 2007.

[9] "The Best Achievable H_2 Tracking Performances for SIMO Feedback Control Systems", *Journal of Control Science and Engineering*, doi:10.1155/2007/93904, 2007.

[10] "Guaranteed Accuracy Algorithm in H_2 Optimal Tracking Controller Synthesis (in Japanese)", *Transactions of the Society of Instrument and Control Engineers*, vol. 43, no. 2, pp. 102-109, 2007.

[11] "Validated Numerical Computation of the L_∞-norm for Linear Dynamical Systems", *Journal of Symbolic Computation*, vol. 41, no. 6, pp. 697-707, 2006.

[12] "On Stability Margins of the Fiat Dedra Engine Model", *IEEE Transactions on Control Systems Technology*, vol. 10, no. 5, pp. 690-695, 2002.

Book Chapters

[1] Hara, S., Kanno, M. 2008, When is a Linear Continuous-time System Easy or Hard to Control in Practice?, *Recent Advances in Learning and Control*, Springer, pp. 111-124.

[2] Kanno, M., Anai, H., Yokoyama, K., 2007, On the Relationship between the Sum of Roots with Positive Real Parts and Polynomial Spectral Factorization, *Numerical Methods and Applications*, Springer, pp. 320-328.