Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Mixed H_2/H_∞ Control—A New Paradigm

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Abstract—A new design paradigm is discussed in this talk which allows control designs to achieve performance complements without trade-off. In particular, a revisit of the mixed H_2/H_∞ control is presented with the proposed new control structure, which is motivated by the famous Youla-Kucera parameterization of all stabilizing controllers. It is shown that this new paradigm is not only able to automatically render the H_2 control performance if there is no modeling mismatch for the plant, but also provide recovery, instead of compromise, of the optimal performance when the modeling error is present, noting that the compromise is normally seen in traditional mixed or multi-objective designs. It is also noted that the recovery of the robust performance is regulated by the "measured error size" of the modeling mismatch, hence, resulting in less conservativeness of the control performance. An inverted pendulum example is presented to validate the design expectations of the new paradigm.

Bio—Xiang Chen received M. Sc. and Ph.D. degree in system and control from Louisiana State University in 1996 and 1998. He held cross-appointed positions in Department of Electrical and Computer Engineering and Department of Mechanical, Automotive and Materials Engineering at the University of Windsor, Ontario, and is currently a Professor in the Department of Electrical and Computer Engineering. He has made fundamental contribution to Gaussain filtering and control, control of nonlinear systems with bifurcation, networked control system, and optimization of field sensing network. He has also made significant contribution to industrial applications of control and optimization in automotive systems and in visual sensing systems for manufacturing through extensive collaborative research and development activities with automotive, robotics, and manufacturing industries. Some of the deliverables have been patented by relevant companies or transferred to technological products of relevant companies. He is currently a Senior Editor for the IEEE/ASME Transactions on Mechatronics, an Associate Editor for SIAM Journal on Control and Optimization, and Associate Editors for International Journal of Intelligent Robotics and Applications, Control Theory and Technology (English Version), and Unman Systems. He received the Award of Best Paper Finalist from 2017 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2017), the Award of Best Student Paper Finalist (as the supervisor author) from 2015 ASME DSCC, the New Opportunity Awards from the Canadian Foundation of Innovation (CFI) and from the Ontario Centre of Excellence–Materials and Manufacturing Ontario, as well as 4 times Research Awards from the University of Windsor. His research has been well supported by government agencies at both federal and provincial levels in Canada and from industrial companies in both Canada and USA. His current research interests include multi-objective complementary optimization and control of systems with complexities, optimization and control of field sensing network and field sensor based autonomous operations, graph-/game-theoretic approaches for complex networked systems, as well as control applications to automotive systems and autonomous vehicles. He is a registered Professional Engineer in Ontario.

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