Abstract

Motion control and robust path tracking were extended to non square MIMO systems having more outputs than inputs in this work. The Non square Relative Gain array (NRG) has been used to assess the performance of non-square control systems based on steady-state information. Using NRG and the SSE (Sum of Square Error), a square subsystem can be selected. MIMO-QFT (Quantitative Feedback Theory) robust synthesis methodology permits to generate the appropriate equivalent MISO (Multi-input Single-Output) system structure from the MIMO (Multi-Input Multi-Output) structure. After that, the CRONE control approach based on third generation CRONE methodology was used to find the controller of the selected subsystem taking into account plant uncertainties. A fractional prefilter synthesis approach was already developed to find a non-integer prefilter expression in order to satisfy the performance specifications. A fully populated matrix controller structure has been proposed to govern
perfectly the multivariable processes. In order to reduce the loop interactions, a coupling matrix
has been designed. A numerical example has been treated in order to verify the proposed
design.

References

- P. Melchior, C. Inarn, A. Oustaloup. Path tracking design by fractional prefilter
  extension to square MIMO systems. In Proceedings of the ASME 2009 International Design
  Engineering Technical Conferences and Computers and Information in Engineering
  Conference, California, USA, 2009.
- S. Mohammad, M. Alavi, A. Khaki Sedigh, B. Labibi, Pre-Filter Design for Tracking
  Error Specifications in MIMO-QFT, In Proceeding of the 44th IEEE Conference on Decision and
  Control, and the European Control Conference, Seville, Spain, 2005.
- E. Boje, Non-diagonal controllers in MIMO quantitative feedback design, International
  Journal of Robust and Nonlinear Control, 2002.
- W. Zenghui, C. Zengqiang, S. Qinglin, Y. Zhuzh, Multivariable Decoupling Predictive
  Eng, 2006.
- I. Horowitz, Survey of quantitative feedback theory (QFT), International Journal of
- S. Skogestad, I. Postlethwaite, Multivariable feedback control, Analysis and design,
- I. Horowitz, Improved design technique for uncertain multiple input output feedback
- M. Garcia-Sanz, I. Egana, Quantitative non-diagonal controller design for multivariable
  systems with uncertainty, International Journal of Robust and Nonlinear Control, 12, 321-333,
  2002.
- M. Garcia-Sanz, I. Egana, M. Barreras, Design of quantitative feedback theory
  non-diagonal controllers for use in uncertain multiple-input multiple-output systems, Control
- M. Barreras, C. Villegas, M. Garcia-Sanz, J. Kalkkuhl, Robust QFT tracking
  controller design for a Car equipped with 4-Wheel Steer-by-Wire, Proc. of the 2006
  IEEE International Conference on Control Applications, Munich, Germany, October 4-6, 2006.
- A. Oustaloup, Fractional order sinusoidal oscillators: optimization and their use in highly
  linear F. M. modulation, IEEE Transactions on Circuits and Systems, Vol. 28(10), 1007- 1009,
  1981.
- A. Oustaloup, B. Mathieu, P. Lanusse, Intégration non entière complexe et contours
  d'isoamortissement, Automatique, Productique, Informatique Industrielle 29(1), 177-202,
  1995.
- P. Lanusse, De la commande CRONE de première génération à la commande CRONE
- A. Oustaloup, B. Mathieu, La commande CRONE: Du scalaire au multivariable, Hermès
- A. Oustaloup, B. Mathieu, P. Lanusse, J. Sabatier, La commande CRONE, 2nd
Design of centralized CRONE controller combined with MIMO-QFT approach applied to non square multivariable systems


**Index Terms**

Computer Science

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**Keywords**

Path Tracking  Non Square Relative Gain Array (nrg)  Crone Control Design  Motion Control  Coupling Effect  Robotics
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