A Study on Advanced Visual Servo Systems Design via Nonlinear Model Predictive Control

2001 Fiscal Year Final Research Report Summary

A Study on Advanced Visual Servo Systems Design via Nonlinear Model Predictive Control

Research Project

Project/Area Number

12650440

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Control engineering

Research Institution

Kanazawa University

Principal Investigator

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Model Predictive Control / Nonlinear Control / Visual Servo / Visual Feedback / Robot Control / Robust Control / H_∞ Control / Digital Control

Research Abstract

Motion control of the mechanical systems with visual feedback is a basic ability of human being. Appli cations that have been proposed widely span manufacturing, car steering and so on. Moreover, the visual feedback control is an important discipline that lies at the intersection between nonlinear control theory and geometric framework of the mechanics and image processing. This research deals with the visual feedback control of robotic manipulators in nonlinear control theoretical aspect.
Firstly, the 3-D visual feedback control problem of the relative rigid body motion is considered as the stabilization problem with respect to the image feature position. By using the representation of SE(3), the relative rigid body motion dynamics between the target object and the camera has been derived. The passivity of the 3-D visual feedback system and the rotational matrix property derive the visual feedback controller to guarantee the asymptotic stability, in the Lyapunov sense.
Next, the principal contribution of this research is the design and analysis of the isual feedback control via the nonlinear model predictive control. Based on the control Lyapunov function and the corresponding feedback control law, the stabilizing nonlinear model predictive control scheme for the 3-D visual feedback system has been proposed. The proposed scheme has employed the cost function as a Lyapunov function for establishing stability.

Research Products (12 results)

All Other

All Publications

[Publications] 藤原幸広: "ビジュアルサーボによる自動車の自動操縦"電気学会論文誌C. 120C-4. 501-506 (2000)

[Publications] T.Azuma: "A New LMI Approach to Analysis of Linear Systems Depending on Scheduling Parameter in Polynomial Forms"at-Automatisierungstechnik. 48-4. 199-204 (2000)

[Publications] 藤田政之: "受動性に基づく非線形視覚フィードバック制御"計測と制御. 40-9. 624-629 (2001)

[Publications] H.Kawai: "Visual Feedback Control of Planar Manipulators Based on Nonlinear Receding Horizon Control Approach"Proc. of the 2001 American Control Conference. 763-768 (2001)

[Publications] H.Kawai: "Visual Feedback Control of Nonlinear Robotics Systems via Stabilizing Receding Horizon Control Approach"Proc. of the 40th IEEE Conference on Decision and Control. 2418-2423 (2001)

[Publications] A.Maruyama: "Stability and Tracking Performance of Dynamic Visual Feedback Control for Nonlinear Mechanical Systems"Proc. of the 40th IEEE Conference on Decision and Control. 4415-4420 (2001)

[Publications] Y. Fujiwara: "Automated Driving by Visual Servoing (in Japanese)"The Transactions of The Insti-tute of Electrical Engineers of Japan. 120C-4. 501-506 (2000)

[Publications] T. Azuma: "A New LMI Approach to Analysis of Linear Systems Depending on Scheduling Parameter in Polynomial Forms"at-Autopmatisjgrungstechnik. 48-4. 199-204 (2000)

[Publications] M. Fujita: "Passivity-Based Nonlinear Visual Feedback Control (in Japanese)"Journal of the Society of Instru-ment and Control Engineers. 40-9. 624-629 (2001)

[Publications] H. Kawai: "Visual Feedback Control of Planar Manipulators Based on Nonlinear Receding Horizon Control Approach"Proc. Of the 2001 American Control Conference. 763-768 (2001)

[Publications] H. Kawai: "Visual Feedback Control of Nonlinear Robotics Systems via Stabilizing Receding Horizon Control Approach"Proc. Of the 40th IEEE Conference on Dicision and Control. 2418-2423 (2001)

[Publications] A. Maruyama: "Stability and Tracking Performance of Dynamic Visual Feedback Control for Nonlinear Mechanical Systems"Proc. Of the 40th lEEE Con-ference on Decision and Control. 4415-4420 (2001)

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