

On the Design of Observer-based Dynamic Visual Servo Systems via Nonlinear H_∞ Model Predictive Control

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2003 Fiscal Year Final Research Report Summary

On the Design of Observer-based Dynamic Visual Servo Systems via Nonlinear H_∞ Model Predictive Control

Research Project

Project/Area Number

14550442

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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Project Period (FY)

2002 – 2003

Keywords

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

Research Abstract

In this research, we consider the design of observer-based dynamic visual servo systems via nonlinear H_∞ model predictive control. Firstly, the 3-D visual feedback control problem is established as the robot control problem and the estimation problem of the relative rigid body motion between the camera and the target object. For this problem, we propose a nonlinear H_∞ model predictive control law for the visual servo systems. Specifically, the appropriate energy function to the proposed control law plays an important role in the control design.

Secondly, the dynamic visual servo system is constructed from a robot manipulator, a camera and an image processing board with a high-performance DSP and a real-time system. While we provide real-time software for implementing the proposed control law to the real system, the algorithm for optimal problems is considered in order

to calculate the controller by the real system.
Finally, we have experiments for evaluating the control performances using the constructed dynamic visual servo system. Experimental results are analyzed exactly by a high-performance workstation. Not only the states of the average but also the states of the worst case are considered in order to verify the proposed control law with experimental results systematically. Moreover, the real-time software and the algorithm for optimal problems are reconsidered via, simulations and experiments.

Research Products (12 results)

AllOther

AllPublications

[Publications] 河合, 東, 藤田: "マニピュレータダイナミクスを考慮したオブザーバ型動的視覚フィードバック制御"システム制御情報学会論文誌. 17-1. 39-47 (2004) ▼

[Publications] H.Kawai et al.: "An Experimental Study of Dynamic Visual Feedback Control on SICE-DD Arm"Proc.of the 42nd SICE Annual Conference. 686-691 (2003) ▼

[Publications] 藤田, 大嶋: "モデル予測制御-VI -ハイブリッドモデル予測制御"システム制御情報学会誌. 47-3. 146-152 (2003) ▼

[Publications] 浅井, 劉, 藤田: "丈夫な制御系をつくる-ロバスト制御"計測と制御. 42-4. 284-291 (2003) ▼

[Publications] 向井, 東, 藤田: "論理混合型ハイブリッドシステムに対するCPI集合を用いたロバストモデル予測制御の一構成法"計測自動制御学会論文集. 39-4. 375-381 (2003) ▼

[Publications] H.Kawai et al.: "A Passivity Approach to Vision-based Dynamic Control of Robots with Nonlinear Observer"Control Problems in Robotics, A.Bicchi, H.Christensen and D.Prattichizzo (Eds),Springer-Verlag. 199-213 (2002) ▼

[Publications] H.Kawai, T.Azuma, M.Fujita: "Observer-based Dynamic Visual Feedback Control of Robotic Systems(in Japanese)"Transactions of the Institute of Systems, Control and Information Engineers. 17-1. 39-47 (2004) ▼

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[Publications] T.Asai, K.Liu, M.Fujita: "How to Design a Tough Control System : Robust Control(in Japanese)"Journal of the Society of Instrument and Control Engineers. 42-4. 284-291 (2003) ▼

[Publications] M.Mukai, T.Azuma, M.Fujita: "Robust Receding Horizon Control for Hybrid Systems based on Constrained Positively In-variant Sets(in Japanese)"Transactions of the Society of Instrument and Control Engineers. 39-4. 375-381 (2003) ▼

[Publications] H.Kawai, S.Izoe, M.Fujita: "A Passivity Approach to Vision-based Dynamic Control of Robots with Nonlinear Observer"Control Problems in Robotics, (A.Bicchi, H.Christensen and D.Prattichizzo(Eds)(Springer-Verlag). 199-213 (2002) ▼

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