

On the Design of Visual Force Feedback Systems for Medical Mechatronics via Hybrid Optimal Control

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2006 Fiscal Year Final Research Report Summary

On the Design of Visual Force Feedback Systems for Medical Mechatronics via Hybrid Optimal Control

Research Project

Project/Area Number

16560381

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Control engineering

Research Institution

Tokyo Institute of Technology (2005-2006)
Kanazawa University (2004)

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Project Period (FY)

2004 – 2006

Keywords

Visual Feedback / Visual Servoing / Robot Control

Research Abstract

In this research, we consider the design of visual force feedback systems for medical mechatronics via hybrid optimal 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 from the camera to the target object. For this problem, we propose a receding horizon control law based on optimization for the 3D visual feedback system, a highly nonlinear and relatively fast system. The stability of the

receding horizon control scheme is guaranteed by using the cost function derived from an energy function of the visual feedback system. Secondly we propose control of visual feedback systems with a dynamic movable camera configuration. This configuration consists of a robot manipulator and a camera that is attached to the end-effector of another robot manipulator. We have experiments for evaluating the control performance using the dynamic visual feedback system that is constructed from two robot manipulators, a camera and an image processing board with a high-performance DSP and a real-time system. Finally we propose hybrid visual force feedback control that is integrated visual feedback control and force control. Simulation results are shown to verify the stability and performance analysis for the disturbance attenuation problem of the visual force feedback system.

Research Products (10 results)

All	2007	2006	2005	2004
		All	Journal Article	

[Journal Article] Passivity-based Dynamic Visual Feedback Control for Three Dimensional Target Tracking : Stability and L2 Performance Analysis	2007	▼
[Journal Article] Passivity-based Dynamic Visual Feedback Control for Three Dimensional Target Tracking : Stability and L_2-gain Performance Analysis	2007	▼
[Journal Article] Predictive Visual Feedback Control with Eye-in-Hand System via Stabilizing Receding Horizon Approach	2006	▼
[Journal Article] 受動性に基づく2次元視覚フィードバック制御の安定性とL2ゲイン制御性能解析	2006	▼
[Journal Article] Passivity-based Visual Force Feedback Control for Planar Manipulators (in Japanese)	2006	▼
[Journal Article] Passivity-based Control of Visual Feedback Systems with Dynamic Movable Camera Configuration	2005	▼
[Journal Article] 受動性に基づく3次元動的視覚フィードバック制御の固定カメラ構造への展開	2005	▼
[Journal Article] Passivity-based 3D Dynamic Visual Feedback Control with a Fixed Camera (in Japanese)	2005	▼
[Journal Article] 一般化終端不等式条件を用いた線形時変システムに対する出力フィードバックReceding Horizon H_∞ 制御	2004	▼
[Journal Article] Output Feedback Receding Horizon H_∞ Control for Linear Time Varying Systems using Extended Terminal Inequality Conditions (in Japanese)	2004	▼

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