Ball & Plate System

GOOGOL TECHNOLOGY

The ball and plate system is a multi-variables, non-linear control target, which is the 2D extension of ball and beam system. The control target is a plate with 2 mutually perpendicular rotating axes, with the aim of balancing a free rotating ball in a specific position on the plate, or having it rotating in a specific trajectory. The rotation of the plate along X-axis and Y-axis are driven by 2 motors, the vision sensor obtains the position of the ball on the plate and feedback to the control system, certain control strategies are applied to control the board for rotating angles along X-axis and Y-axis by the control system, and thus the balancing position and the motion trajectory of the ball on the plate is achieved.

System Characteristics

- Position of the ball is detected by visual device.
- PC+ motion controller open architecture control platform is used
- DC serve motors are adopted in driving joints
- 1000-line rotary encoder is used to detect the 2D rotating angles
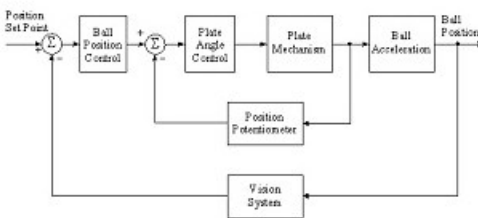- High performance image acquisition card & camera lens

Technical Specification

L x W x H	600mm x 300mm x 400mm
DC motor rated power	36W
Power	AC220V 50HZ 3.2A
DC brush motor ratio	1:10
Diameter of ball	25mm
Image pixel	768 x 576
Sampling frequency	> 25fps

Image acquisition card	- Support the acquisition of NTSC, PAL, RS170 and CCIR standard video source - Dual visual decoder structure allows quick switching of channels - Can connect and switch with 16 CVBS channels, 8Y/C or composite input channels - 16-channel TTL I/O auxiliary interface and RS-485 serial interface - Watchdog timer is used to surveillance the system integrity - Support 32-bit 33/66 MHz PCI bus mode - Software development package includes Matrox Imaging Library (MIL)/ActiveMIL, MIL-Lite/ActiveMIL-Lite - Support Microsoft Windows 2000 and WindowsXP O/S

Reference experiments:

- Identification of Demarcation of linearity and non-linearity model of video recorders
- Model-building of System dynamics modeling & analysis
- Application and research of image processing calculation algorithms
- 2D servo control based on visual vision technology
- Research of PID controller and other classical control calculations methods
- Research of self-defined control calculations algorithms

Control Examples:

- Position the ball to the centre of the plate
- Position the ball to a specific point on the plate
- Movement of the ball to a particular position via a specific trajectory
- Travelling of the ball to a certain point under local limitation of rotation in a certain direction (+/- 10 degrees)

System Configuration: **Hardware**

Main Body	DC servo motor driven; Platform dimension: 300mm x 300mm; Base dimension: 400mm x 400mm
Electric control module	GPB2001 specific
Visual model	Image acquisition card (xl) + CCD (xl)

System Configuration: **Software**

Ball and plate control software; LabView experiment software

Model Number	Mode Name	Product Configuration	
GPB-2001	Ball & Plate system	APB-MB-2001	Main body
		GT-400-SV-PCI-EDU	GT-400-SV motion controller
		APB-EB-2001	Electric control module
		APB-VM-2001	Ball & plate visual module
		SPB-VC-2001	Ball & plate control software