COB1154 AN INTEGRATED CONTROL STRUCTURE FOR SURGICAL ASSIST ROBOTICS FOR LAPAROSCOPY

A.P. Slade,* J.R. Hewit,* A. Cuschieri, T. Frank
*Department of Applied Physics, Electronic and Mechanical Engineering, University of Dundee, Dundee, Scotland, DD1 4HN. U.K. E-mail: A.P.Slade@dundee.ac.uk J.R.Hewit@dundee.ac.uk
Ninewells Hospital, Department of Surgery, Dundee, Scotland, DD1 9SY. U.K.
E-mail: A.Cushieri@dundee.ac.uk T.G.Frank@dundee.ac.uk

Minimal Access Surgery, commonly known as keyhole surgery is revolutionising surgery and has been established as a major complement to open surgery. Its growing popularity in recent years, with both patients and surgeons, is due to the numerous advantages it offers over conventional surgery. These include small access wounds (typically 5 or 10 mm in diameter), no forceable retraction of tissue or organs, shorter recovery times and smaller scars. However, these must be balanced by the increased complexity leading to longer operating times and the need for even skilled surgeons to undergo special training in minimal access techniques. The problems of Minimal Access Surgery can be reduced by using robotic systems and intelligent control and interface techniques. In this paper, the authors describe a fully integrated control structure, with three different command and control input systems, which is used to control a compact six degree of freedom surgical assist robot.

Keywords: *Telemanipulator; Surgical Robotics; Endoscope; Voice control; Integration*

COB1190 VARIABLE STRUCTURE CONTROL APPLIED TO LINEAR HYDRAULIC ACTUATORS

Luís Gustavo C.O. Lopes[1] , Edson R. DePieri[2] & Raul Guenther[3]
1 Lab. Controle e Microinformática, Departamento de Automação e Sistemas - CTC/UFSC
2 Departamento de Engenharia Mecânica - CTC/UFSC
3 Departamento de Engenharia Elétrica e Sistemas de Potência - CT/UFPE

The work presented in this paper is concerned about robust control design applied to robots with hydraulic actuators. A cascade structure is used to decouple the mechanical dynamics from hydraulics. Once a linearizing control for the hydraulic part is obtained, a sliding mode outer-loop control is applied to garantee closed-loop performance.

Keywords: *Hydraulic actuators, cascade control, variable structure, sliding modes, robustness*
/Atuadores. hidr'aulicos, controle em cascata, estrutura vari'avel, modos deslizantes, robustez

COB 1332 INTERAÇÃO DO SISTEMA DE CONTROLE E A ESTRUTURA FLEXÍVEL DE UM SATÉLITE DURANTE TRANSFERÊNCIA ORBITAL / *INTERACTION BETWEEN CONTROL SYSTEM AND FLEXIBLE STRUCTURE OF AN SATELLITE DURING ORBIT TRANSFER.*

Adenilson Roberto da Silva, Luiz Carlos Gadelha de Souza
Departamento de Mecânica Orbital e Controle, Instituto Nacional de Pesquisas Espaciais – INPE
São José dos Campos – CEP 12227 – 010 São José dos Campo, Brasil - adenilson@dem.inpe.br
gadelha@dem.inpe.br

In this paper, the interaction between the attitude control system and the flexible structure of an artificial satellite during orbit transfer maneuvering has been investigated. The satellite was modeled by a rigid central body with one or more flexible appendages. The dynamics equations were obtained by a Lagrangean approach. The flexible appendages were treated as a clamped-free beam and its displacement was discretized by assumed-mode method. In the satellite transfer maneuver a typical Hohmann procedure and a burn-coast-burn strategy were used, the attitude was controlled by on-off controller. As a result, it was verified that if any jet fire cycling near the fundamental frequency of flexible appendages, a possibility of the interactions between control system and flexible structure can exist which could damage the performance of control system. Therefore, as security, in the control system design a bandwidth with one decade below of first natural frequency of the flexible structure should be used.

Keywords: *Estruturas Flexíveis, Sistemas de Controle, Transferência de Órbita / Flexible structures; Control Systems; Orbit Transfer*

COB1338   DYNAMICS AND DESIGN OF AUTONOMOUS ATTITUDE CONTROL OF A SATELLITE USING FUZZY LOGIC

Rodrigo Guerra, Sandra Sandri & Marcelo Lopes de Oliveira e Souza
National Institute for Space Research-INPE - CP 515, 12201-970, São José dos Campos - SP - Brazil
E-mail: guerra@dem.inpe.br; sandri@lac.inpe.br; marcelo@dem.inpe.br;

Fuzzy logic has rapidly become one of the most successful of today's technologies for developing sophisticated control systems. With its aid, complex requirements may be implemented in very simple, easily maintained and low cost controllers, suitable for small satellites. The increase of satellite autonomy is a continuing goal for improving its performance and reducing its operations costs. One approach to this autonomy is to use fuzzy logic in the controller, specially under modeling uncertainties, which has several features that make it a useful tool for maneuver automation. This current analysis investigates the use of a fuzzy logic controller to the acquisition and control of rotation of a spin stabilized satellite. It is possible to control the satellite motion around its spin axis through the correct switching of two magnetic coils within specified ranges by fine tuning the fuzzy control set domains and by adapting them automatically to reduce error tolerance. Such controller is currently under development and its effects on the satellite dynamics and control will be discussed and compared with a classic controller in this work. Several advantages were found under this approach, including simplicity, flexibility and robustness.

Keywords: *Fuzzy Logic Control; Satellite Attitude Control; Operational autonomy / Controle Nebuloso; Controle de Atitude de Satélites; Autonomia Operacional*

COB1339   SIMULAÇÃO DIGITAL EM TEMPO REAL DE UM SISTEMA DE CONTROLE DE ATITUDE MAGNÉTICO AUTÔNOMO DE UM SATÉLITE ESTABILIZADO POR ROTAÇÃO/*REAL TIME DIGITAL SIMULATION OF AN AUTONOMOUS GEOMAGNETIC ATTITUDE CONTROL SYSTEM OF A SPIN STABILIZED SATELLITE*

Silvano Vargas Prudêncio & Marcelo Lopes de Oliveira e Souza
Instituto Nacional de Pesquisas Espaciais - INPE
Cx. Postal 515, CEP 12201-970 - São José dos Campos, SP, Brasil, E-mail: silvano@dem.inpe.br; marcelo@dem.inpe.br