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Resúmenes en Inglés
English Abstracts

Decision-Making in Robotics

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Abstract: This paper presents, as a tutorial, an overview of the current state of the decision-making problem applied to robotics. The study is approached in a comprehensive and inclusive way and, therefore, trying not to go into specific solutions for specific problems. The article is focused primarily on high-level decisions to be taken by a robot, not lower-level decision-making problems that are solved using traditional control techniques or with very specific algorithms. We refer to "decisions" of a robot in the broad sense of determining the activities performed by it. That is, without any a priori exclusion based on issues such as the decision-making strategy used, the type of robot, the performed tasks, etc. The article is structured in a number of sections that addresses various topics of interest in robotics, from the perspective of decision-making: autonomy, intelligence, goals, high-level decisions, decision-making strategies, control architectures, perception, human-robot interaction, learning and emotions.

Keywords: Robotics, decision-making, control architectures, autonomy, intelligence, human-robot interaction, learning, emotions.

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Development of a Virtual Reality Interface for Smart Multiagent Robotic System

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Abstract: This article presents the multi-agent robotic system SMART. This system is integrated by different kind of software and / or hardware agent, so it can be classified as heterogeneous. Additionally, it is presented the development of a virtual reality interface through which a human user can acts on the system if it is necessary, otherwise the system operates autonomously. Also, this interface implements a different features aimed to achieve the performance of the whole system. The interface allows to reproduce the real scene and provides the user with information in real time what happens in reality. Because of heterogeneous system, communication between agents is made using different communication technologies (TCP / IP, WiFi and Bluetooth), therefore it was necessary to design a specific communication protocol that is described in this article.

Keywords: robots, agents, distributed artificial intelligence, virtual reality, cooperation.

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Adaptive Control for Mobile Robots with Uncertain Dynamics using Neural Networks.

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Abstract: This paper presents an adaptive trajectory tracking control for mobile robots for which stability conditions and performance evaluation are given. The proposed control structure combines a feedback linearization model, based on a kinematics nominal model, and a direct neural network-based adaptive dynamics control. The control system design is done considering uncertain dynamic parameters in the dynamic model of the robot. The uncertainty in the dynamics model is learned by a RBF neural network in an adaptive feedback loop, adjusting the weight and the radial basis functions. The proposed RBF-NN scheme is computationally more efficient than the case of using the learning capabilities of the neural network to be adapted, as that used in feedback architectures that need to back propagate the control errors through the model (or network model) to adjust the neurocontroller. The resulting adaptive controller is efficient and robust in the sense that it succeeds to achieve a good tracking performance with a small computational effort. Stability result for the adaptive neuro-control system is given. It is proved that control errors are ultimately bounded as a function of the approximation error of the RBF-NN. Experimental results show the practical feasibility and performance of the proposed approach to mobile robots.

Keywords: mobile robot control, nonlinear control, neural nets, dynamic control.

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Vibration Control of Rotating Machines

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Abstract: Vibration caused by mass imbalance is a common problem in rotating machinery. In this paper, a review of the performed research work on active balancing and active vibration control for rotating machinery is presented. In addition, two solutions to this vibration attenuation problem for desired output feedback trajectory tracking tasks are proposed. The first one consists in the use of a movable bearing to modify the effective rotor length and, as an immediate consequence, the natural frequency, to avoid the higher amplitudes presented in the resonance. The second one consists in the use of an active disk mounted on the main inertia of the rotor system, which contains a balancing mass that can be positioned in any angular and radial position inside the disk to attenuate the vibration caused by the residual unbalance. Since both active vibration control strategies require information of the eccentricity, the algebraic identification method is used for the on-line estimation of its parameters.

Keywords: Active Vibration Control, Rotor Active Balancing, Eccentricity Identification.

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Intelligent PID Based Control: an Application to Robust Cruise Control in Urban Environments

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Abstract: In spite of its limitations, the most widespread industrial control technique is still today PID control. In this article, a new approach, intelligent PID based control (i-PID), will be presented. It takes advantage of its strength, while it improves one of its main weak points: the loss of performance in presence of non-linear terms or unmodeled dynamics. To show the i-PID behavior it has been implemented on a real application, the robust cruise control of an experimental vehicle in urban environments. Copyright © 2010 CEA.

Keywords: PID controllers, nonlinear control systems, robust controllers, autonomous vehicles, speed control.

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Centralized Multivariable Control with Decoupling Variable Speed Wind Turbines

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Abstract: The design of control systems for wind turbine generators of variable speed represents an important challenge since these are nonlinear multivariable processes, with strong disturbances, diverse constraints and great interaction among its variables. Under this scenario the electric power must be generated efficiently and at the same time to regulate the speed of the turbine. This paper proposes several schemes of multivariable control, with the aim of improving the performance of the wind turbines, attenuating the effects of the interaction among their variables. The proposed solution is based on PID controllers with designs of type decentralized, centralized with diverse decoupling nets and a scheme with four PI. The behaviour of the wind turbine is described by means of a nonlinear mathematical model, that becomes linear to obtain a transfer function matrix, from which the controllers are designed. Finally a comparative analysis is realized to determine which controller presents better results, applying disturbances with an additional wind speed model and random changes of the electric load. Copyright © 2010 CEA.

Keywords: Wind Turbine, Multivariable Control, Modeling, Interaction.

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Application of Position and Inertial-rate Control to a 2-DOF Gyroscopic Platform

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Abstract: This paper presents a control application for the inertial stabilization of a gyroscopic platform with two degrees of freedom (2-DOF). The purposes of this application are, first, to control the angular positions of the platform in the absence of inertial disturbances and second, to control velocities measured in an inertial frame, while rejecting the disturbances associated with moving components. With regard to the first objective, a switching-control strategy is proposed in order to reduce the effects of friction as the main source of undesirable non-linear behaviors. Regarding the inertial-rate control, a master-slave control structure is suggested to achieve the desired specifications. Simulation and experimental results are presented, showing the performance attained on a real platform.

Keywords: Inertial platform, adaptive control, gain scheduling.

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Vector Control of an Induction Motor with Unknown Load Based on New Nonlinear Observer

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Abstract: In this paper a sensorless vector control scheme for induction motor, which works in a whole range of speed, is presented. Controller is based on a low order and semiglobal convergence new observation algorithm which simultaneously estimates fluxes and rotor speed with constant and unknown load. Performance of sensorless field oriented controller proposed is verified by means of numeric simulation for tracking of variable speed including the zero speed and it is compared with obtained results for the same control scheme based on model reference adaptable system observer.

Keywords: Sensorless vector control, induction motor, speed observer.

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Automatic Detection of a Calibration Pattern for Automatic Camera Calibration

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Abstract: The number of applications that need to calibrate cameras is increasing. Present methods can calculate camera parameter in a semi-automatic way. Because of that full-automatic methods are being researched in order to save user's time and effort. The algorithm proposed in this article uses a pattern similar to a chessboard. It is automatically found in every image without previous information of the number of files or columns. To do this, a joint analysis of the line set that form the pattern is found through the Hough transform, corners and projective invariants. Some examples and a comparison with other methods are shown.

Keywords: Error analysis, camera calibration, image distortion, pattern recognition, computer vision.

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