Revista Iberoamericana de Automática e Informática Industrial
ISSN: 1697-7912. Vol. 3, Núm. 2, Abril 2006, pp. 124-129
http://riai.isa.upv.es

## RESÚMENES EN INGLÉS
## *ENGLISH ABSTRACTS*

### REAL-TIME SYSTEMS OVERVIEW

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Abstract: The great grow in the development of industrial embedded systems has caused a renewed interest on real-time systems. This paper tries to analyze the topics with higher impact in the development of real-time systems, and to identify some of the most important aspects and proposals in this domain. For this purpose, a description of main topics such as scheduling policies, programming languages, operating systems and distributed systems has been presented. The goal has been to provide an insight in the most basic topics, instead of give a deep perspective in some selected items. In this way, the reader can have a broader view of this interesting research area. *Copyright © 2006 CEA-IFAC.*

Keywords: Real-time systems, industrial computing applications, embedded systems

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 7-18

### ORK: RELIABLE SOFTWARE TECHNOLOGY FOR REAL-TIME SYSTEMS

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Abstract: Control systems with strict reliability and safety requirements must have a predictable temporal behavior, enabling designers to ensure that real-time requirements are guaranteed in all cases. The paper describes an execution platform for this kind of systems based on ORK, the Open Ravenscar real-time Kernel. ORK is aimed at developing high-integrity real-time systems using a safe subset of the Ada programming language. *Copyright © 2006 CEA-IFAC.*

Keywords: Real-time systems, computer controlled systems, safety, critical systems, high-integrity systems..

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 19-27

## TOWARDS THE INTEGRATION OF REAL-TIME TOOLS USING AN OPEN MODEL

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Abstract: This paper presents MAST, a suit that integrates tools for the analysis and design of real-time distributed systems, which enables their interoperability along the development process, and is open to extend its modeling capabilities and tools with new algorithms and design methods. Its architecture is described, it is based on the formal, standardized and extensible specification of the data structures that support the real-time models and the results that are obtained from the tools. These data structures as well as the modeling methodology constitute the basis for the interoperability among its tools. The available tools are presented and the appropriateness of them for the development of real-time distributed applications is justified, in particular when using Ada95 or real-time operating systems POSIX 1003.13 compliant. 

Keywords: Real-Time, Distributed Systems, CASE tools, Schedulability Analysis.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 28-39

## ANALYSIS AND COMPENSATION OF SCHEDULING DELAYS IN CONTROL SYSTEMS.

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Abstract: There is a gap between control design phase and its real-time implementation in such a way that every phase assumes some simplifications on the other phase. This leads to a undesired behavior of the controlled system. In recent years some works have pointed out the need of integrating both phases. The goal of this work is to study the negative influence of delays in a control system, focusing in control delays and the techniques used to reduce it. 

Keywords: Real-time systems, scheduling, delay compensation.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 40-49

## DYNAMIC RESOURCE ALLOCATION IN REAL-TIME CONTROL SYSTEMS

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Abstract: Most traditional resource management techniques for real-time systems with multiple control loops are based on "open-loop" strategies that statically allocate a constant CPU share to each control task, independent of the plant dynamics of each control loop. This provides average control performance with minimal overhead but in general fails to provide the best performance possible within the available resources. We show that by using dynamic resource allocation for control tasks, overall control performance can be significantly improved. We present an optimal resource allocation policy that maximizes control performance within the available resources. We provide experimental results on a real-time system that show the benefits of the proposed policies and corroborate the presented theoretical results. *Copyright © 2006 CEA-IFAC.*

Keywords: Real-Time Systems, Computer-Controlled Systems, Resource Allocation, Optimization.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 50-60

## rtfCANopen: AN IMPLEMENTATION OF CAN BUS FOR EMBEDDED SYSTEMS

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Abstract: This paper describes the design and implementation (hardware and software) of rtfCANopen, which it is a communication system based on CAN bus and suitable for the requirements of embedded systems. Those requirements imposed by the development of real time distributed systems to the communication system are discussed. The obtained conclusions are applied in the design of rtfCANopen. Some features of rtfCANopen: it is based in a high level standard protocol (CANopen); it needs of few resources (in terms of memory) to work; the nodes can download the software, configure and start up automatically; the control engineer does not have to concern about network issues. Furthermore, rtfCANopen can be used by its own but it fits in a coherent development process model supported by RTF (Real Time Framework). RTF is a tool set that aids the engineer by performing globally and coherently some tasks like: worst case execution time computing, timing analysis, priority assignment to messages and mapping of signals to messages. As a case study, rtfCANopen is used to control a mobile robot with path tracking capabilities. *Copyright © 2006 CEA-IFAC.*

Keywords: field buses, distributed control systems, microprocessor based systems.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 61-70

## SCoCAN: A REAL TIME COMMUNICATION PROTOCOL FOR DISTRIBUTED EMBEDDED SYSTEMS. APPLICATION TO ROBOT CONTROL.

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Abstract: This paper describes the design and implementation of distributed architecture intended for use in distributed control systems, as is the case of mobile robots. In this architecture the distributed embedded nodes has been implemented, as well as a communication protocol called SCoCAN (Shared Channel on CAN). This protocol enables real time communication between different intelligent nodes (sensors, actuators and controllers). SCoCAN is based on a hybrid communication scheme (Time Triggered-Eevent Triggered), that guarantees a minimum jitter in sensor-control-actuator loops. The distributed nodes have RT-Linux as operating system for the management, control and scheduling under real-time constraints. 

Keywords: distributed control, embedded system, real time, fieldbus system, robotics.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 71-78

## ARCHITECTURE FOR SERVICE TELEOPERATED ROBOT CONTROL

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Abstract: The teleoperated robots are used to carry out tasks in dangerous or difficult to reach environments. Nowadays, it is possible to find several control architectures for this kind of systems. However, none of them is capable to cope with the requirements of all the systems, due to great variability that exists among them. The purpose of this paper is to present a new architectural framework (ACROSET) that takes into account the recent approaches in software architectures, specially the component based development (CBD). The CBD provides a common framework for systems development with very different behaviours and allows the integration of intelligent components. The architecture is being used in the EFTCoR project for the development of a family of robots (teleoperated cranes and vehicles) that perform maintenance tasks over the hull ships surfaces. 

Keywords: software architecture, teleoperation, real time systems.

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 79-89

## CONTROLLER DESIGN BASED ON QFT FOR ACTIVE DAMPING OF CHATTER VIBRATIONS IN CENTERLESS GRINDING MACHINES

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Abstract: With the aim of improving the grinding process stability avoiding chatter, an active damping system embedded in the centerless grinding machine Estarta MDA 327 (www.estarta.com) is presented. A piezoelectric actuator compensates chatter vibration, improving the machine performance derived from the trade-off between surface quality and productivity. In this paper, the controller design based on QFT is shown, including performance specifications concerning robust stability, constraint in control effort, and disturbance rejection. 

Keywords: QFT, Frequency Domain, Robust Control, Manufacturing Systems, Vibration Control

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 90-98

## MOBILE ROBOTS PROGRAMMING

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Abstract: The goal of this paper is to describe the software frameworks of the most used mobile robots, their features and the current trends in the field. The mobile robots software is organized in three levels: operating system, software framework and particular applications. The robotic software frameworks have emerged in last years, they aim to make easier the development of new robotic applications. They use to provide a standard abstract interface to the robot hardware, a particular software architecture for the applications and a set of already developed capabilities, ready for reuse. 

Keywords: Robot programming, autonomous mobile robots, software tools, programming environments, simulators

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 99-110

## HELICOPTER PITCH CONTROL AS A BENCHMARK FOR DESIGN OF CONTROLLERS

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Abstract: A benchmark problem for controller design is introduced in this paper. The objective is to design a controller that meets the performance specifications of a helicopter pitch control. The paper describes the helicopter, its analytic and experimental model and the cost function to be minimized. The input-output data of the plant are also provided on the benchmark site. The proposed solutions will be evaluated with the actual helicopter test-bed in the Lab. 

Keywords: Pitch control, helicopters, system identification, controller design, benchmark

RIAI, Vol. 3, Núm. 2, Abril 2006, pp. 111-116