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On a Hybrid Control Structure in Automotive Applications

Virginia Ecaterina Oltean, Radu Dobrescu and Dan Popescu



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Hybrid systems, combining time-driven and event-driven dynamics, have emerged in past decade as an important modelling and control framework for automotive applications. An important class of problems related to performance improvement of modern cars is the cut-off control. In the hybrid dynamical model of the engine and power train, called in the sequel, the Balluchi model, the subsystem representing the power train is continuous, but the objectives of the cut-off control drive to switching control laws. This paper studies a simplified version of a cut-off control solution, earlier reported in the literature, as a hybrid supervision structure (HSS) with interface. Adequate techniques for MATLAB simulation of the closed loop hybrid system, ensuring Zeno path avoidance, are proposed.

Key words: hybrid system, cut-off control, simulation, Zeno path.

2000 Mathematics Subject Classification: 53B25, 53C15.

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Model Predictive Control Solutions for Vehicular Power Train Systems
Claudia Adina Dragoș, Stefan Preitl, Radu Emil Precup, Cristian Sorin Neș and Emil Petriu



[Full text](#)

The paper presents theoretical and implementation aspects concerning Model Predictive Control (MPC) solutions using the polynomial equivalent structure. Generalized Predictive Control (GPC) solutions are also developed in this paper. A mechatronic application is included to show how the MPC solutions can be implemented. The paper presents details on the modelling of a class of vehicular power train systems with Continuously Variable Transmission (CVT) with focus on an analytical analysis of systems' components. Digital simulation results for an economic driving scenario are pointed out to validate the MPC solutions.

Key words: Continuously Variable Transmission, Generalized Predictive Control, mechatronic application, Model Predictive Control, vehicular power train system.

2000 Mathematics Subject Classification: 34H05, 49J15, 93C55, 93C83, 93C85.

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Use of a Configurable Torque-Speed Dependence for Power Maximization of Squirrel-Cage-Induction-Generator-Based Wind Energy Conversion System

Adriana Scarlat, Iulian Munteanu, Antoneta Iuliana Bratcu and Emil Ceangă



[Full text](#)

The aim of this paper is to propose controllable torque–speed dependence for power maximization of squirrel-cage-induction-generator–based wind energy conversion system. It uses a vector control scheme and allows imposing both the slope and the zero-torque point of a generator forced mechanical characteristic. A better dynamic, along with extended domain of stable operation and controllable generator torque variations, is thus obtained. Through numerical simulation, closed-loop dynamics and stability analysis are performed for the proposed control method.

Key words: wind energy conversion systems, wind turbine control, optimization methods, stability, asynchronous machine field-oriented control.

2000 Mathematics Subject Classification: 34D20, 49J15, 34H05.

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Modelling and Control of an Autonomous Energetic System Obtained Through Trigeneration

Sergiu Caraman, Marian Barbu, Viorel Mînză, Nicolae Badea and Emil Ceangă



[Full text](#)

The autonomous energetic system is for a residential building and it has as primary sources exclusively renewable resources (biomass and solar energy). For obtaining electrical energy, photovoltaic sources and a Stirling engine are used. They operate simultaneously in 1:3 ratio – electrical/thermal energy. Solar collectors and a pellet boiler are used to cover the necessary of thermal energy. The air conditioning in the summer regime is obtained using an adsorption plant. The energetic deficit is critic in the electrical subsystem where the load control is done through the adjusting of the Stirling engine power. The thermal power of this engine is a disturbance variable at the level of the thermal subsystem. The paper deals with the developing of a mathematical model of the whole system. The paper also proposes a control solution for the load regulation in the electrical and thermal subsystems and it presents the results obtained through numerical simulation.

Key words: Stirling engine, mathematical modeling, numerical simulation.

2000 Mathematics Subject Classification: 37M05, 34H05, 93A30.

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Hybrid Modelling and Control for a Two-Tank System

Florin Stîngă and Andreea Şoimu



[Full text](#)

A hybrid control system is a control system with analog and digital parts. In this paper, the problem of modeling, control and implementation of the control scheme for a two-tank plant is approached. Also, for the proposed hybrid control scheme we studied several proprieties, such as: Zeno behavior, reachability analysis, blocking automaton. These proprieties of the hybrid system can offer sufficient information for the control and implementation phases. The control scheme is a hybrid scheme, which combine a classical controller and a controller based on logical rules, taking in consideration the physical restrictions imposed on the control input and plant outputs. The implementation of the proposed control scheme has been made on a PLC (programmable logical controller), using ladder diagrams. Some experimental results are presented in order to illustrate the performance of the proposed control method.

Key words: hybrid control, Zeno behavior, blocking automaton, ladder diagrams, reachability analysis.

2000 Mathematics Subject Classification: 34K35, 93B99.

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The Influence of Chromatic and Luminance Noise on Scale-Invariant Descriptors

Lucian Carata and Vasile Manta



[Full text](#)

It is largely accepted that algorithms like Scale Invariant Feature Transform (SIFT) or Speed-Up Robust Features (SURF) are highly robust, a quality that makes them practical in a large range of applications concerning object recognition, tracking or reconstruction. This paper sets to determine whether the observed instability of some of the interest points determined with such algorithms is a result of the algorithm's sensitivity to noise, performing a detailed analysis of the way stability is affected by camera chromatic and luminance noise. Those are the most common types of noise that appear in image acquisition systems, and are difficult to control due to their time-varying and non-deterministic nature. The analysis is performed on 4 sets of images (~ 200 images each), captured with commodity hardware and with no post-processing, assuring realistic conditions. The implications of the results are discussed, along with possible improvements that could increase interest point stability.

Key words: luminance noise, interest points, SIFT, SURF.

2000 Mathematics Subject Classification: 68U05, 65D18.

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An Overview of Temporal Coherence Methods in Real-Time Rendering

Daniel Scherzer



[Full text](#)

Most of the power of modern graphics cards is put in to the acceleration of shading tasks because here lies the major bottleneck for most sophisticated real-time algorithms. By using *temporal coherence*, *i.e.* reusing shading information from a previous frame, this problem can be alleviated. This paper gives an overview of the concepts of temporal coherence in real-time rendering and should give the reader the working practical and theoretical knowledge to exploit temporal coherence in his own algorithms.

Key words: rendering, temporal coherence, reprojection, interpolation, shadow map.

2000 Mathematics Subject Classification: 68U05, 65D18.

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Real-Time Rendering and Animation of Vegetation

Ralf Habel



[Full text](#)

Vegetation in all its different forms is almost always part of a scenery, be it fully natural or urban. Even in completely cultivated areas or indoor scenes, though not very dominant, potted plants or alley trees and patches of grass are usually part of a surrounding. Rendering and animating vegetation is substantially different from rendering and animating geometry with less geometric complexity such as houses, manufactured products or other objects consisting of largely connected surfaces. In this paper we will discuss several challenges posed by vegetation in real-time applications such as computer games and virtual reality applications and show efficient solutions to the problems.

Key words: rendering, virtual reality, real-time graphics, translucency, reflectance, branch motion.

2000 Mathematics Subject Classification: 68U05, 65D18.

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Object Tracking in Real Time Video Sequences Using a Fast Level Set Method

Bogdan Apostol And Vasile Manta



[Full text](#)

We propose a method for determining the shape (2D outline of the object) and follow-up position (set of simple geometric transformations on position), using a level set based curve evolution and combining the benefits of using the pixel-wise posterior term with a fast level-set algorithm to approximate curve evolution. The pixel-wise posterior allows us to marginalize the model parameters at pixel level, and the fast level-set algorithm avoids the need of solving partial differential equations (PDEs). Our proposed implementation can accurately process a higher number of frames per second, bringing real-time performance on standard hardware systems.

Key words: object tracking, active contours, image segmentation, fast level set, PWP.

2000 Mathematics Subject Classification: 68U05, 65D18.

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From WELSA 1.0 to WELSA 2.0: Accommodating Social Learning Features

Elvira Popescu



[Full text](#)

WELSA 1.0 was conceived as an intelligent adaptive educational system, which provides individualized courses, according to students' learning styles. What the initial version of WELSA is missing is the social dimension of learning (*i.e.*, students' opportunity to interact, communicate and collaborate with their peers, actively creating and sharing knowledge). In this paper, we aim to add several social learning features to WELSA, by integrating a set of Web 2.0 tools into the platform. Our approach is motivated by the recent advent of social software tools in education (*e.g.*, blog, wiki, social bookmarking systems, media sharing tools etc.), with encouraging results. The paper opens with a discussion of the implications of Web 2.0 for education, including a successful case study. Next, WELSA 1.0 is briefly presented. Finally, a mashup-based solution is described for the integration of the Web 2.0 tools; the necessary extensions for each system component are also introduced, leading towards WELSA 2.0.

Key words: adaptive educational system, learning style, Web 2.0, social software, social learning environment.

2000 Mathematics Subject Classification: 97U50, 68T05.

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Enhanced Interfaces for Parameter Adjustment in Volume Rendering Applications

Marius Gavrilescu, Muhammad Muddassir Malik And Eduard Gröller



[Full text](#)

Volume visualization involves the graphical processing and on-screen rendering of a volume dataset for the purposes of exploring, classifying and viewing information from the underlying data. Often, the manual adjustment of the various parameters involved in the rendering process can become a tedious task, especially given the ever increasing complexity of volume rendering applications. We attempt to optimize parameter control by providing the user with a-priori information on parameter behavior and stability. Our technique involves a screen-space analysis of the effect of parameter changes across the entire value domain. This is achieved through a combination of a custom image comparison metric and various means of information visualization, such as graphs or color mapping. We illustrate our technique by appropriately modifying frequently used interface elements, such as sliders or transfer function controls. We show how these new interface elements allow a more precise control of their respective parameters, as well as provide the user with information on parameter behavior and stability.

Key words: interface elements, parameter behavior, information visualization, volume rendering.

2000 Mathematics Subject Classification: 68U05, 65D18.

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GPU Method for Registering Multiple Mri Sequences *Paul Herghelegiu, Cristian Smochină and Vasile Manta*



[Full text](#)

The visualisation of soft tissues of the human body represents a key step in the diagnostication process of neurological diseases. Physicians usually use Magnetic Resonance Imaging (MRI) as a medical imaging technique to acquire data concerning soft tissues in a non-invasive manner. Most of the medical applications developed so far use a segmentation step to separate a specific organ, followed by a tri-dimensional reconstruction process. In this paper, we introduce a new method of combining data obtained along different scanning plans of the same patient. In order to obtain a real time result, we extend the classical Ray-Casting algorithm and we use the features of Graphical Processing Unit (GPU) programming. For avoiding the computational load on the conventional CPU when transforming a 3D texture, our method implements the three basic transformations (rotate, scale, translate) onto the RGB cubes used in the Ray-Casting algorithm.

Key words: volume visualisation, volume reconstruction, medical imaging.

2000 Mathematics Subject Classification: 65D18, 68U05.

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Dynamic Simulator for an Electro-Hydraulic Wet Clutch *Emanuel Feru, Daniel Pătraşcu and Corneliu Lazăr*



[Full text](#)

The dynamic behaviour of an electro-hydraulic wet plate clutch offers many advantages regarding the reduction of fuel consumption, shifting quality and improvement of driving comfort. In this paper, an analytic model of a wet plate clutch actuated by a pressure reducing valve is developed. Next this model is converted into a Simulink model, with which simulation can be performed in an easy way. To validate the model a test bench, developed by Automotive Continental Romania, was used.

Key words: automatic transmission, clutch, valves, hydraulic actuators, displacement, simulators, nonlinear systems.

2000 Mathematics Subject Classification: 53B25, 53C15.

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The Design of Temperature Control System Using PIC18F4620

Bogdan Levărdă and Cristina Budaciu



[Full text](#)

Applications that require temperature control are often meet in industry. In this paper a low cost application for temperature control in a ventilation system using the PIC18F4620 was designed and developed. Ventilating is the process of changing or replacing air in any space to control temperature or remove moisture, smoke, dust, unpleasant smells or bacteria. Ventilation in a test room refers both to the exchange of air to the outside as well as circulation of air within a room. This study includes real time temperature control using a PID controller implemented on a microcontroller.

Key words: temperature control, educational low cost application, PID controller, PIC18F4620.

2000 Mathematics Subject Classification: 93C10, 93C40, 93C83.

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