AUTOMATIC CONTROL and COMPUTER SCIENCE Section

CONTENTS

Comparative Study for Synthesis of Digital Systems Using Decomposition Algorithms
Mihai Timiş, Alexandru Valachi and Călin Monor

Full text

In this paper, the authors propose a comparison study on two approaches regarding the synthesis of digital systems using logical functions decomposition algorithms with implementation in PLD and FPGA devices. This work continues the research of the decomposition algorithms that was largely described previously in paper (Valachi et al., 2013). It is developed a comprehensive theory of serial decompositions for multiple-output, partially specified and Boolean functions.

Key words: decomposition algorithms; Boolean functions; programmable logic devices (PLD); field programmable gate array (FPGA).

2010 Mathematics Subject Classification: 06E30, 49M27, 94C05

Wavelet Based Image Compression Using Different Techniques: A Comparative Study

Usman Ali Khan, Sahar Arshad, Tahir Riaz Sindhu and Shayan Qazi

In this paper, we are going to implement different wavelet based techniques for image compression and these are: wavelet based embedded zerotree Wavelet (EZW), Set Partitioning In Hierarchical Trees (SPIHT), Wavelet Difference Reduction (WDR), Spatial-orientated Tree Wavelet (STW), 3D-Set Partitioning in hierarchical trees (3D-SPIHT) and Adaptively Scanned Wavelet Difference Reduction (ASWDR). Here, for this purpose we will use MATLAB R2010a. With the help of these implementation we can measure the effectiveness of all these techniques. From JPEG algorithms, wavelet based image compression is giving significantly better results. In this way it is appearing as a really effective technique for image compression. With the help of these algorithms we find different performance parameters like PSNR, CR, BPP and MSE. By calculating these performance parameters we can evaluate comparisons amongst these techniques. Through these mentioned compression techniques we can achieve better MSE and PSNR values w.r.t CR which shows that for images these are more efficient for than DCT.

Key words: image compression; EZW; BPP; SPIHT; WDR; STW; PSNR; 3D-SPIHT; MSE; CR; ASWDR; DWT; MATLAB.

2010 Mathematics Subject Classification: 93E11, 68P30.

Comparison of Pitch Control System for an Unmanned Free-Swimming Submersible Vehicle with PD Controller and Linear Quadratic Regulator Using MATLAB

Mohammad Jawad Masud, Faisal Fayyaz Qureshi, Abdul Rehman Chishti, Muhammad Zubair Aslam, Muhammad Azhar Ghauri and Nasir Naeem

In this paper we have examined the results of the pitch control system, that are used in robotic submersible automobiles by using PD controller and linear quadratic regulator and results are compared. The penetration of the vehicle is well-ordered in a way that during frontward motion an elevator seeming on the vehicle is identified by a nominated aggregate. The identification reasons the automobile to revolve about the pitch axis. The pitch of the axis generates a vertical influence that causes the vehicle to immerse or grow. It is to be guaranteed for pitch control analysis that pitch angle of automobile should follow the pitch command angle. The class of tracing is well-ordered by the pitch control. In the first part of the paper, we have observed performance of closed loop control systems without any controller. Second part is related to the investigation of the performance in closed loop system controlled by means of a proportional integral controller. After that system performance is improved using derivative controller. Then PD controller on the system is implemented. The simulation results are taken as well. Finally, system performance is also been observed by using linear quadratic regulator and results are compared.

Key words: Unmanned free swimming submersible vehicle (UFSS); vehicle model; pitch control system; system response; step response; PD controller; linear quadratic regulator.

2010 Mathematics Subject Classification: 93C83.

Radio Telescope Antenna Azimuth Position Control System Design and Analysis in MATLAB/Simulink using PID & LQR Controller

Abdul Rehman Chishti, Syed Fasih-ur-Rehman Bukhari, Hafiz Saad Khaliq, Mohammad Hunain Khan and Syed Zulfiqar Haider Bukhari

A position control system converts an input position command to an output position response. Antennas, computer disk drives and robot arms contains many applications of position control system. The radio telescope antenna utilizes position control systems. In this paper the design and control of antenna azimuth position has been implemented. The response of the system is analysed and results are drawn by using PID controller, the results of PID controller are further improved by adding Linear Quadratic Regulator. We have seen that the LQR results are much better than the results obtained by PID controller.

Key words: LQR; PID controller; system response; azimuth position control; MATLAB simulation.

2010 Mathematics Subject Classification: 93C83, 34C60

Software Application for Regression Analysis and Process Optimization

Doina Caşcaval and Petru Caşcaval

A software application for regression analysis and optimization is presented in this paper. The optimization method implies firstly to identify a regression equation able to express the relationship between the function of interest and other independent variables for which some measurements can be obtained. For the regression equation, a factorial method is implemented. To simplify the regression equation, some less significant coefficients can be ignored. Finally, the statistical test Fisher-Snedecor is applied to validate entirely the mathematical model. With a regression equation in hand, one can determine the values of the independent variables, within an optimization area, for which the variable of interest has a maximum value or a minimum one, as applicable. To solve this optimization problem, the regression equation is transformed firstly into a canonical form. The function of interest is then represented graphically by some curves of constant level. A case study that illustrates the utility of this dedicated program is also presented in this paper.

Key words: nonlinear regression equation; factorial methods; statistical test; canonical form; process optimization.

2010 Mathematics Subject Classification: 90C90, 65K10.

Implementation Issues for Distributed Model Predictive Control of a Two Agent System
Anca Maxim, Constantin F. Căruntu and Corneliu Lazăr

In recent years, the process industry has increasing demands on performance, production and efficiency in the industrial processes. At the same time, these processes consist of more and more independent, but interacting subsystems, becoming more complex from a global perspective. The current trends indicate a preference for implementing more complex, but effective control systems, with diagnostic functionalities able to improve the overall performance of the processes and to deal with the interaction between subsystems. The aim of this paper is to design and implement a control strategy which achieves the optimal performances for such systems from a global perspective with respect to specific quality demands. A major difficulty is the presence of strong interactions between the subsystems. To this end, a distributed model predictive control method was implemented and the performances obtained in simulation were compared with the ones obtained with centralized and decentralized model predictive control strategies. The simulation results suggest that the distributed control strategy has similar performances as the centralized control and is slightly better than decentralized control.

Key words: model predictive control; interacting subsystems; distributed control; centralized control; decentralized control.

2010 Mathematics Subject Classification: 68M99, 68W35

Designing 3D Audio and Haptic Interfaces for Training the Sound Localization Ability of the Visually Impaired People
Oana Bălan and Alexandru Butean

An assistive device, based on an alternate sensory modality, such as hearing or touch, can help the blind individuals to gain spatial awareness, to enhance their navigational skills and to improve their life quality. The purpose of our research is to develop a navigational system that would enable the visually impaired people to travel and orient in space by substituting the visual sense with relevant auditory information and haptic cues. As the proposed visual-substitution system will employ 3D binaural sounds synthesized from non-individualized Head Related Transfer Functions which offer an ambiguous spatial acoustic perception, we identified the need for training the visually impaired subjects' sound localization abilities through a perceptual feedback based learning approach. This paper outlines the design and implementation of the 3D audio and haptic interfaces that we used for training and testing the spatial acoustic perception of the visually-impaired subjects who participated in our experiment.

Key words: 3D sound, training, HRTF, virtual auditory display, haptic, blind people.

2010 Mathematics Subject Classification: 00A06.

Region Detection and Depth Labeling on Kinect Streams
Alexandru Butean and Oana Bălan

Although Kinect was designed as a gaming tool, in the last few years studies have shown that this sensor can be used for real-time environmental scanning, segmentation, classifications and scene understanding. Our approach, based on using Kinect or any other similar device, gathers depth and RGB data from the sensors and processes the information in near real time. The purpose is to divide the data into distinct regions based on depth and colour and then calculate the distance for each detected area (depth labelling). To achieve performance in many real situations involving humans, compared to other existing segmentation or depth calculation solutions, right from the beginning, we considered the fact that humans are different than objects. Most of the objects are static and thus, they are less likely to change their dimensions and localization into every frame. We propose a method where regions are detected by merging 2 different segmentation methods: human detection using skeletal tracking and RANSAC algorithm as a method for object detection. Our experimental results are showing that the solution running on a mobile device (notebook) works with a humble improvement of maximum 7% compared to the RANSAC object detection method.

Key words: depth labelling, 3D segmentation, human detection, Microsoft Kinect, scene understanding.

2010 Mathematics Subject Classification: 00A06.