International Multi-Conference on Systems, Signals & Devices

Summary Proceedings

Volumes I, II, III and IV

SSD08, July 20-23, 2008

Philadelphia University, Amman, Jordan

Fifth International Multi-Conference on Systems, Signals and Devices SSD'08

July 20-23, 2008 Amman Jordan

Organized by:

Philadelphia University (Jordan)

University of Sfax, Ecole Nationale d'Ingénieurs de Sfax (ENIS), (Tunisia)

University of Chemnitz, (Germany)

Supported by:

IEEE Region 8

IET Jordan Branch

Philadelphia University (Jordan)

Jordan Engineering Association (Jordan)

Tunisian Scientific Society (TSS) (Tunisia)

Amanat Amman (Jordan)

General Chairs:

Ibrahim Badran (Jordan), Hans-Rolf Tränkler (Germany)

Co-Chairs:

Kasim Al-Aubidy (Jordan), Nabil Derbel (Tunisia)

Organizing Chairs:

Ashraf I. Saleem (Jordan), Mohammad S. Sharawi (Jordan)

Conference Chairs:

Conference SAC: Munther N. Baker (Jordan), Mohamed Chtourou (Tunisia)

Conference PES: Mahmoud Zaidan (Jordan), Ahmed Masmoudi (Tunisia)

Conference CSP: Abdel-Rahman Qawasmi (Jordan), Faouzi Derbel (Germany)

Conference SCI: Tarek Tutunji (Jordan), Olfa Kanoun (Germany)

Organization Committee:

Publications Team: Ashraf I. Saleem (Jordan), Mohammad Al-Gawanem, Moez Feki (Tunisia), Ahmad Abu Alhaija (Jordan), Feryal (Jordan),

Web Team: Mai Al-Noursi (Jordan), Waleed Jayyousi (Jordan)

Social and Publicity Team: Mohammad Ajor (Jordan), Tarek Tutunji (Jordan),

Financial Team: Moahmod Zeidan (Jordan)

Members: Amin Kallel (Tunisia), Chokri Rekik (Tunisia), Lassaad Koubaa (Tunisia), Yassine Bouteraa (Tunisia), Nouha Chaabène (Tunisia), Aida Drira (Tunisia), Sura Barakat (Jordan),

Contents

International Multi-Conference on Systems, Signals & Devices

Volume I
Summaries of the Conference on
Systems, Analysis & Automatic Control

ISBN 978-9973-959-08-9

SSD08, July 20-23, 2008

Philadelphia University, Amman, Jordan

Fourth International Multi-Conference on Systems, Signals & Devices

Conference on Systems, Analysis & Automatic Control

Conference chairs:

Munther N. Baker (Jordan), Mohamed Chtourou (Tunisia)

Program committee members

Mohamed M'Saad (FR)	Faiçal Mnif (OM)	M. N. Abdelkrim (TN)
R. Ben Abdennour (TN)	Ouassima Akhrif (CND)	Saif Al-Hiddabi (OM)
Abdulwahid AlSaif (KSA)	Fouad Al-Sunni (KSA)	Dumitru Baleanu (TUR)
Mohamed Benrejeb (TN)	Jacques Bernussou (FR)	Maurice Bétemps (FR)
Mammar Bettayeb (UAE)	Eric Bideaux (FR)	Pascal Bigras (CND)
Fares Boudjemaa (ALG)	El-Kebir Boukas (CND)	Bernard Brogliato (FR)
Xavier Brun (FR)	Jean Louis Calvet (FR)	Riccardo Caponetto (IT)
Mohamed Chaabane (TN)	Yang Quang Chen (USA)	Slim Choura (TN)
Carlos Cotta (ES)	Boutaïeb Dahhou (FR)	Tarak Damak (TN)
Jean Duplaix (FR)	Sami El-Ferik (KSA)	Gilles Enéa (FR)
Jelel Ezzine (TN)	Mondher Farza (FR)	Ghorbel Fathi (USA)
Gérard Favier (FR)	Florin G. Filip (RO)	Germain Garcia (FR)
Moncef Gasmi (TN)	N. Ben Hadj Braïek (TN)	Dorin Isoc (RO)
Anas Kamoun (TN)	Mohamed Kamoun (TN)	Jean Pierre Kenné (CND)
Christophe Kolski (FR)	J. A. T. Machado (PT)	J. Aguilar Martin (FR)
Pierre Melchior (FR)	Khaled Metwally (EGY)	Faouzi M'Sahli (TN)
Abderrazak Ouali (TN)	Ahmet B. Özgüler (TUR)	Minh-Tu Pham (FR)
A. Poznyac (MEX)	Joseba Quevedo (ES)	Maarouf Saad (CND)
Manabu Sano (JP)	Mansour Souissi (TN)	Marc Thomas (CND)
Daniel Thomasset (FR)	Ahmed Toumi (TN)	Blas M. Vinagre (ES)
Herbert Werner (GER)	Tony Wong (CND)	Ronald Yager (USA)
Lotfi Zadeh (USA)		

Contents

Keynote Lecture

Papers

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-Plenary-1

Building tomorrow's electrical engineers

Isam Zabalawi
Higher Education Consultant, Jordan

Abstract

Technology has often been cited as the major driving force behind innovation in higher education and for educational reform in a variety of contexts. Modern digital technologies such as computers, telecommunications, and networks are reshaping and eventually revolutionizing both our society and our social and educational institutions. A new society, the knowledge society is thus arising, the elements of which coexisting with the constitutive elements of the industrial and postindustrial society. The most obvious aspect of the new society is the speed of use, application and dissemination of the communication and information technologies, which puts in the shade the fact that there occurs a major transformation of concepts, structures and institutions specific to the previous society. Within the technological context, electrical engineers play a significant role. They develop new design, manufacturing processes and products. They advance and manage communication, transportation, health care devices and energy systems. They address the environmental issues and the make technology work. The electrical engineering activities generate a remarkable potential for the private and the public sectors to develop the national wealth and strength. The chairman of the American National Academy of Engineering noted that "the nation the best engineering talent is in possession of the core ingredient of comparative economic and industrial advantage".

Index-Terms: Electrical Engineering.

Biography of the speaker: Dr. Zabalawi was born in Amman, Jordan (1950). He received his B.Sc. honors with distinction in electrical engineering (communications)in 1974 from Cairo University (Egypt), and his M.Sc. with distinction in Microwave Communication Engineering form Leeds University (England) in 1976, and his Ph.D. in Electrical and Electronics Engineering from Leeds University (England) in 1979. He was granted The Leeds University award for graduate studies for three years 1976-1979.

Dr. Zabalawi is specialized in analog and digital signal processing and communication techniques. His interests include: communication industry, information technology, and technology transfer and higher education development.

Dr. Zabalawi served as the founding president for the newly established private university in Syria the International University or Science and Technology (IUST) from May 2005 until May 2007.

Dr. Zabalawi was the minster of Higher Education and Scientific Research in Jordan during the period Oct.2003 until April 2005.

Dr. Zabalawi was the Chancellor of the University of Sharjah from 1999-2003. In 1999 he became the Chairman of the Higher Education Accreditation Council of Jordan. In 1996 he became the Vice-President (Scientific and Medical Faculties) of the University of Jordan. In 1994 he headed the Electrical and Electronics Engineering Dept. of the College of Engineering at Sultan Qaboos University, Sultanate of Oman. Between 1989-1993, he served as the Dean of the Faculty of Engineering and Technology, University of Jordan, Amman, Jordan. Prior that he chaired the Department of Electrical and Electronic Engineering at the University, where he taught a number of courses in his field at the undergraduate and graduate levels and he supervised a number of graduate theses.

Dr. Zabalawi was an active member in the higher education development team. He has organized and chaired a number of regional and international conferences and workshops. He is a well-published research scholar. He was a research fellow with the German Academy of Exchange (DAAD) at the University of Karsruhe, the Technical University of Hamburg, and the University of Erlangen, Germany. In addition he was a Research fellow, Electrical Engineering Dept., University of Victoria, Victoria, Canada and Research Fellow with Telenokia, Helsinki, Finland.

Dr. Zabalawi served (1993-1999) as the IEE (Institution of Electrical Engineering, UK.). Council Representative for Jordan and Gulf States. He is a Chartered Engineer and a senior member at the IEEE (Institute

of Electrical & Electronics Engineers, New York, USA, Fellow (FIET), Institution of Engineering and Technology , (IET) UK. He is a member of many societies such as, Circuits and Systems Society, IEEE, USA. Vehicular Technology Society IEEE, USA. Acoustics, Speech, and Signal processing Society, IEEE, USA. Member, Processing Society, IEEE, USA. Member Jordan Engineering Association, 1974.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-Plenary-1

Control and safety verification based on a paraconsistent logic program EVALPSN

Kazumi Nakamatsu
School of Human Science and Environment, University of Hyogo, Japan

Abstract

I have already proposed a paraconsistent annotated logic program called Extended Vector Annotated Logic Program with Strong Negation (EVALPSN),which can deal with defensible deontic reasoning. EVALPSN has been applied to various intelligent control and safety verification systems such as pipeline valve control, railway interlocking safety verification, etc. Moreover, EVALPSN has been developed to deal with before-after relation between two processes and it can be applied to process time control and process order safety verification. The developed EVALPSN is called bf (before-after) EVALPSN. It will be introduced how to apply EVALPSN and bf-EVALPSN to intelligent control and safety verification with some concrete examples and simulation systems in the speech.

Index-Terms: Control, safety, logic program EVALPSN.

Biography of the speaker: Dr. Kazumi Nakamatsu has been a professor at School of Human Science and Environment, University of Hyogo since 2004. His research focuses on application of formal logics, especially paraconsistent annotated logic program, with applications to computer science area. He has developed a paraconsistent logic program called an EVALPSN (Extended Vector Annotated Logic Program with Strong Negation), and applied it to intelligent control and safety verification for various systems such as railway interlocking safety verification, pipeline valve control, traffic signal control, etc.. He has applied a PAT in terms of intelligent process order control based on EVALPSN. In ad-

dition to the research listed here, Dr. Nakamatsu has published many journal articles, book chapters and conference papers, edited books published by major world-wide publishers, been the editor-in-chief of the International Journal on Reasoning-based Intelligent Systems(Inderscience Publishers,UK) and an editorial board member of some other international journals, and a chair of international conferences and symposium sessions.

Education: Dr. Sci. Informatics (Kyushu University) 1999 M.S. Computer Science (Shizuoka University) 1978 B.S. Computer Science (Shizuoka University) 1976.

Professional Experience: Department of Management and Informatics, Himeji College of Hyogo 4/1990-3/1998. School of Humanity and Environment Policy of Technology, Himeji Institute of Technology 4/1998-3/2004 School of Human Science and Environment, University of Hyogo 4/2004-

Research Interests: Development and Application of the paraconsistent logic program EVALP.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-SAC-Keynote-Lecture

The use of DSPs as controllers in Mechatronics

Tarek A. Tutunji
Philadelphia University, Amman, Jordan.

Abstract

Mechatronics engineering can be defined as the analysis, design, and integration of mechanics with electronics through intelligent controllers. This engineering branch has gained much attention in recent years because of the fast development of integrated engineering applications in the industry. As the requirements for real-time, fast, and accurate controllers increased, the use of Digital Signal Processors (DSP) as controllers gained momentum. This is due to the fact that DSP architecture has many advantages over regular microcontrollers such as pipelining, parallelism, multiple-buses, and high acquisition rates. DSP applications in mechatronics include automotives, robotics, military, and hard disc drives. Hard disc drives presents a suitable mechatronic application that uses DSP as controllers and therefore will be used as an illustrative example. This paper will discuss the following: mechatronic systems, DSP architecture, DSP applications as mechatronic controllers with emphasize on hard disc drives.

Index-Terms: Mechatronics, DSP.

Biography of the speaker: Dr. Tarek Tutunji is currently serving as the chairman of the mechatronics department / faculty of engineering at Philadelphia University in Jordan. He has six years of practical experience in manufacturing and design development. He started his career as a manufacturing engineer with Halliburton Energy Services, Texas where he was responsible over electronic testing of PCB's and systems. He then moved within Halliburton to the research depart-

ment where he worked on developing optimization algorithms to classify oil logging data. Later, he worked as a senior design development engineer with Seagate Technology, Oklahoma City. His responsibilities included system design of hard disc drives. He has a PhD in industrial engineering (1996) and MS in electrical engineering (with speciality in DSP), both from University of Oklahoma, USA. He joined Philadelphia University in 2002 and since then he has been involved in many local and regional workshops concerned with developing mechatronics education. He teaches DSP, Microcontrollers, Machine Intelligence, and Digital Control. His research interests include identification of mechatronic systems, DSP, machine intelligence, and mechatronics education. He has two U.S. patents and more that 18 publications in internationally recognized journals and conferences.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569111431

Fuzzy identification of dynamic systems with adaptive structure

Sonia Alimi and Mohamed Chtourou
National School of Engineers of Sfax, Tunisia

Abstract

This paper deals with two approaches for on line structure identification of fuzzy models. In the first one, a constructive algorithm is adopted to generate the fuzzy rules: it starts with a single pattern and a single fuzzy rule and grows progressively to reduce the system error within the specified tolerance. In the second one, an evolutionary algorithm is applied based on an alternation between incremental and pruning criteria. Indeed, the rule base is expanded when the model can not reduce the system error and one rule is removed if it has a petty contribution in the model output along some patterns. The presented approaches have been applied for two examples of dynamic systems to compare the identification performance.

Index-Terms: Structure identification, constructive algorithm, evolutionary algorithm, fuzzy inference system.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569114451

Identification of diffusion processes using fractional non commensurate order models

Tounsia Djamah,[1] Said Djennoune[1] and Maamar Bettayeb[2]

[1] *Laboratoire de conception et conduite de systèmes de productique, University M. Mammeri of Tizi-Ouzou, Algeria*

[2] *Department of electrical & computer engineering, University of Sharjah, UAE*

Abstract

This article deals with heat transfer modeling and identification, based on fractional non commensurate order state space models. An output error method is developed to estimate the model parameters including the fractional order and an iterative non-linear programming method is used, based on a novel fractional multivariable sensitivity functions model. Numerical simulation data of the heat transfer problem are performed using finite differences, and the suggested method is applied to identify the thermal process. Two fractional non commensurate models are tested in order to analyze their fitting ability to approximate the interface diffusion in the frequency domain.

Index-Terms: Fractional non commensurate order system, modeling, output error identification, Marquardt algorithm, heat transfer.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120820

Marine propeller dynamics modeling using a frequency domain approach

Matthieu Vonnet, Nadia Ait-Ahmed and Luc Loron

Institut de Recherche en Electrotechnique et Electronique de Nantes Atlantique (IREENA), Saint-Nazaire, France

Abstract

This paper reports the modeling, identification and experimental validation of a marine propeller dynamic model. In fact, the existing models well reproduce propeller thrust and torque, but only at low dynamics. In practice, the rate of change of propeller rotational speed is then limited by the thruster controllers to avoid unmodeled phenomena. Otherwise important tracking error can occur during transient responses. In both cases, the dynamic performances of the whole controlled system are limited. To avoid this difficulty, we propose a dynamic model for marine propeller based on a frequency domain approach using a Wiener-Hammerstein model. The identification is carried out using a harmonic study of the asymptotic response of the model to a sinusoidally varying input. Simulations and experiments are performed to evaluate the performances of the proposed model.

Index-Terms: Propulsion, underwater vehicle control, modeling, simulation, nonlinear systems

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120885

A stochastic failure compensation controller of induction motor based state estimation technique

A. Maouche,[1] M. R. Mekideche[1] and B. Bensaker[2]

[1] *LAMEL Laboratory, Jijel University, Algeria*

[2] *Department of Electronic Engineering, Annaba University, Algeria*

Abstract

The purpose of this paper deals with the stochastic failure compensation controller of induction motor based state estimation technique. It is well known that induction motor drives are widely used as important parts in industrial applications. In consequence it must be carefully controlled to ensure optimum, profitable and reliable operations. However induction motor drive systems are also known as complex non-linear time-varying systems. Based on the fact that the system model can be significantly simplified if one applies in addition with the $d-q$ Park transformation an appropriate field orientation technique, an adequate model structure of the induction motor is obtained. The observer-based state variable estimation technique, stochastic and determinist, is used for control and monitoring of the considered induction motor system. Finally a simulation example of is given to point out the merits of the proposed approach for stochastic optimal compensation and control for induction motor.

Index-Terms: Modelling, Stochastic optimal control, Fault tolerance, Induction motor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120896

State observer of bilinear systems subjected to unknown inputs

C. Mechmeche,[1] H. Hamdi[1] and H. Yahoui[2]

[1] *Laboratoire d'Etude et Commande Automatique des Processus (LECAP), Ecole Polytechnique de Tunisie, Tunisia*

[2] *Laboratoire Ampère Université Claude Bernard Lyon 1, France*

Abstract

In this paper, a constant gain unknown input observer (U.I.O) for bilinear systems is proposed. The design procedure is based on the solution of an LMI which ensure the observer stability using Lyapunov approach, the norm of the estimation error decays to zero asymptotically. Sufficient existence conditions for the U.I.O are given. The efficiency of the new observer design method is applied to a semi-active suspension vehicle.

Index-Terms: Bilinear systems, Unknown input observer, Lyapunov stability, state estimation, LMI

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569121808

A method for on-line identification and control based on hardware-in-the-loop concept

Ashraf I. Saleem and Tarek A. Tutunji
Philadelphia University, Jordan

Abstract

A method to identify and control a mechatronic system in real time environment is presented in this paper. Acquiring the system's transfer function accurately can be difficult if some parameters are missing. This causes a great difficulty in the system modeling and control. Therefore in this research, a method based on Hardware-in-the-Loop (HIL) concept has been employed to identify and control dynamic systems. Online identification using Auto Regressive Moving Average (ARMA) models is used to identify the transfer function of the system; the controller is tuned on the identified model in a simulation environment and applied to the real system. The advantages of the proposed method are high accuracy in the identified system, simplicity, and low cost. Two case studies, namely, a DC motor and servo-pneumatic system, were used to verify the proposed method.

Index-Terms: Identification, Control, Hardware-In-The-Loop

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569107074

Designing an expert system of liver disorders by using neural networks and comparing it with parametric and nonparametric system

Mehdi Neshat,[1] Mehdi Yaghobi[1] and Mohammad Naghibi[2]

[1] *Department of Computer Engineering, Azad University press Mashhad, Iran*

[2] *Department of computer engineering, engineering and architecture faculty, Ferdoosi University, Iran*

Abstract

In this essay, we are going to design a medical expert system by using neural network. In order to test the system, we used the data in the intended bank *e.g.* BUPA liver disorders. We compare the operation of the system with parametric methods like Bayesian decision making theory and non parametric methods. By analysis of the data, we first discovered an undesirable field in the bank which causes to decrease learning rate of the system. When we omitted this field, we concluded very good results. By comparing the three above systems, we concluded that the neural network has the best operation and effect in liver disorder diagnosis. This result has also been improved so far.

Index-Terms: Medical expert system, neural network, Bayesian theory, parametric method, liver disorder.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569113939

Optimization by GRBFNN of the performance of a novel linguistic fuzzy model of induction motor

L. Barazane,[1] A. Khwaldeh,[2] M. M. Krishan[3] and M. A. Jumah[4]

[1] *University of Science and Technology Houari. Boumediene, Algeria*

[2] *Philadelphia University, Jordan*

[3] *Al-Balq'a Applied University, Jordan*

[4] *Royal University for women, Bahrain*

Abstract

In this paper, two emerged systems: Neural networks and fuzzy systems are used in order to improve the performances of induction motor drives. As a first step, an approach of linguistic fuzzy modeling proposed by Ben-Ghalia is applied to induction motor. Thus, a classical model is first given with feedback linearization. After more, in order to minimize the dependence of the system to parameter variations and external perturbations, and reduce the number of variable states, a new model of the original system is proposed. This model is suitable to cognitive approach such as fuzzy modeling. On the other hand, to improve the performances especially the robustness towards parameter variations and external perturbations of the overall system based on the new proposed fuzzy model, a speed Gaussian Radial Basis Function Neural Network controller is used. Finally, simulation study is carried out and the results revealed very interesting features.

Index-Terms: Feedback linearization control, fuzzy modeling approach, nonlinear feedback based on modeling, Gaussian radial basis function neural network controller, induction motor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569116808

Synthesis of a robust neural input-state feedback controller for nonlinear systems

Sondess Jerbi,[1] Nabil Derbel[1] and Houssem Jerbi[2]

[1] *Research Unit ICOS, University of Sfax, Tunisia*

[2] *Research Unit LECAP, Ecole Polytechnique, Tunis, Tunisia*

Abstract

This paper presents a design approach to hybrid control systems, combining analytical feedback linearization control techniques with neural networks. Such a mixed implementation leads to a more effective control design with improved system performance and robustness. The main objective of integrating neural networks is to overcome the problems with uncertainties in the plant parameters and structure encountered in the analytical model-based design. Shunt Dc motor is characterized by complex nonlinear and time-varying dynamics and inaccessibility of some model parameters for on line measurements, and hence can be considered as an important challenging engineering topic. The input-state feedback linearization technique is known for its good results locally in a neighborhood of an operating point. However, these results are sensitive to model parameter variations and so performances may deteriorate. Neural network-based controllers are considered as candidates for this parameters sensitivity. In a first step, an algorithm for analytical exact input-state linearizing control is formulated. The following step is dedicated to the robust neural feedback controller design. A simulation study of these methods is presented. The effectiveness of the neural controller with respect to the analytical one is demonstrated for a large armature resistance variation.

Index-Terms: input-state feedback linearization, parametric variation, neural networks, shunt DC motor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569118518

Neural network control of an induction machine operating with variable parameters

Chokri Rekik, Mohamed Djemel and Nabil Derbel
ICOS, Ecole Nationale d'Ingénieurs de Sfax, Tunisia

Abstract

This work is aimed at looking into the determination of control strategies of nonlinear systems. The basic idea consists in the decomposition of the global system into interconnected subsystems. Are considered systems whose subsystems are linear with respect to their state and control vectors; on the other word, nonlinearities are located in the interconnection terms. Then, for each subsystem, local optimal feedback gains are easily expressed in terms of interconnection vectors. Such optimization has been successfully achieved using a neural net yielding the optimal gain at each step time. The induction machine is considered in order to illustrate the proposed approach.

Index-Terms: Interconnected subsystems, neural networks, nonlinear systems, induction machine.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120851

Neural networks based control of chaotic phase locked loop

Mohamed Mchiri,[1] Safya Belghith[1,2] and Zouhair Ben Jemaa[1]

[1] *Ecole Nationale d'Ingénieurs de Tunis (ENIT), Tunisia*

[2] *SYSCOM Laboratory, Tunis, Tunisia*

Abstract

In this paper, a neural network controller is applied to control (suppress) chaotic behavior in a theoretical model of a third order Phase Locked Loop (PLL). It is demonstrated that the neural network controller can successfully cause the phase error to behave in a desired way. The performance of the neural network control method is compared to that of previously used LTI filters showing hence, the efficiency of neural networks (NNs') based control.

Index-Terms: Chaos, Control, Neural networks, Narma-L2, PLL.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569107058

Multi-objective optimization of TSK fuzzy models

Ouahib Guenounou,[1] Ali Belmehdi[1] and Boutaieb Dahhou[2]

[1] *University of Béjaia, Algeria*

[2] *LAAS, CNRS, Toulouse, France*

Abstract

In this paper we propose a hybrid algorithm to optimize the structure of TSK type fuzzy model using Backpropagation (BP) learning algorithm and Non-dominated Sorting Genetic Algorithm (NSGA-II). In a first step, BP algorithm is used to optimize the parameters of the model (parameters of membership functions and fuzzy rules). NSGA-II is used in a second phase, to optimize the number of fuzzy rules and to fine tune the parameters. A well known benchmark is used to evaluate performances of the proposed modeling approach, and compare it with other modeling approaches.

Index-Terms: genetic algorithms/NSGA-II, fuzzy rules, backpropagation, hybrid algorithm.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569117342

A discussion on sugeno fuzzy logic approximations of nonlinear systems

Nabil Derbel
National Engineering school of Sfax, Tunisia

Abstract

This work is aimed at looking into the use of fuzzy systems for the study of nonlinear systems. In a first step, zero-order and first-order Sugeno fuzzy models are defined as approximators of nonlinear systems. It has been found that zero-order fuzzy systems are equivalent to the classical interpolation approach. Nonlinear terms have been limited by two fuzzy systems. The mean fuzzy system gives good accuracy. As illustrations, some numerical applications have been considered to show the efficiency of the use of fuzzy systems to study nonlinear problems.

Index-Terms: Nonlinear problems, zero-order sugeno fuzzy systems, first-order sugeno fuzzy systems, nonlinear approximators.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120848

Some clustering techniques for modeling uncertain nonlinear systems

Ali Zribi, Mohamed Djemel and Mohamed Chtourou
ICOS, Ecole Nationale d'Ingénieurs de Sfax, Tunisia

Abstract

This paper presents popular unsupervised clustering algorithms based on neuro-fuzzy, fuzzy c-means (FCM) and agglomerative techniques. The purpose of this paper is to provide clustering methods able to cluster the data patterns without a priori information about the number of clusters. We will show that it is possible to reconcile the FCM algorithm with the unsupervised clustering algorithms. Finally, to show the efficiencies of these algorithms, we will apply them to model the behavior of uncertain system.

Index-Terms: FCM clustering, Neuro-fuzzy clustering, Agglomerative clustering, Unsupervised clustering.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120854

Multi-objective optimal fuzzy logic controller for nonlinear building-MR damper systems

Mohsen Askari and Amir H. Davaie-Markazi
Iran University of Science and Technology (IUST), Iran

Abstract

This paper focuses on the benchmark control problem for seismically excited nonlinear buildings and reports the application of a semi-active control scheme on the 20-story benchmark building using magnetorheological (MR) damping technology. As the fuzzy logic control systems have been applied effectively in various fields, a multi-objective optimal fuzzy logic control system has been proposed in this paper to manage the required voltage of MR dampers. Non dimensionalized peak floor acceleration index from building response category, and ductility index from building damage category, have been considered as the two objective functions to be minimized. All the rule-bases, MFs and scaling factors are tuned well through a recursive optimization algorithm using a pareto optimal solution, namely NSGAII. The optimization procedure has been done by consideration of 10 various earthquakes in order to provide a more robust controller. The proposed semi active intelligent control scheme satisfies the control constraints and is tabulated according to the evaluation criteria provided by the benchmark problems for comparison with other schemes. Finally, performance of the proposed control system has been found to be better than the other schemes.

Index-Terms: Fuzzy control, NSGAII, MR Dampers , Nonlinear building, T-S fuzzy model

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120856

Fuzzy logic parameter estimation of an electrical system

Majed Jabri, Houda Chouiref, Houssem Jerbi and Naceur Benhadj Braiek

Laboratoire d'Etude et de Commande Automatique des Processus (LECAP), Ecole Polytechnique de Tunis, La Marsa, Tunisia

Abstract

Fuzzy logic systems have been extensively and successfully applied in control system over the past few years. However, they have been used much less often to estimation problems. Accordingly, this work proposes an application of fuzzy logic controller to estimate parameters of a series DC motor. The field and the armature resistance estimation of DC series motor is an important problem in order to implement a robust closed-loop control. Hence, the resistance is estimated by using fuzzy logic method according to the process behavior reflected in the measured output data. Generally, the parameter estimation is done by minimizing the coast criteria and using the squared error or other function. However, in the present development we try to replace the coast criteria batch and the optimization algorithm by fuzzy logic system

Index-Terms: Parameter estimation, Fuzzy logic, DC motor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569114804

Real-time intelligent process order control based on a paraconsistent annotated logic program EVALPSN

Kazumi Nakamatsu,[1], Seiki Akama[2] and Jair Abe[3]

[1] *University of Hyogo, Japan*

[2] *Tsukuba University, Japan*

[3] *Paulista University, Brazil*

Abstract

In this paper, we introduce a paraconsistent annotated logic program called bf-EVALPSN that can deal with before-after relation between two processes. We show that bf-EVALPSN can be suitably applied to real-time process order control with a simple pipeline process example. We also briefly introduce practical inference rules in bf-EVALPSN to reason before-after relations.

Index-Terms: intelligent control, process order control, beforeafter relation, paraconsistent annotated logic program, EVALPSN.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569117336

Tracking and regulation in linear multivariable systems: a frequency domain approach

Paul Leesha, Jacob Jeevamma and Mathew T. Abraham
National Institute of Technology, India

Abstract

This paper outlines a constructive procedure for the synthesis of linear multivariable systems subjected to constant reference input and constant disturbance in the partial state. The synthesis procedure is capable of producing a stable desired closed loop transfer matrix which can be expressed as the product of an open loop transfer matrix and any proper rational transfer matrix, assuming that the given system has no zeros at the origin. The closed loop transfer matrix is realized via integral feedforward compensation with asymptotic state estimation while simultaneously eliminating the effect of steady state disturbance at the output and track a constant reference input. The conditions for achieving a variety of specific design goals such as 1) closed loop stability, 2) static decoupling with complete and arbitrary closed loop pole placement, and 3) dynamic decoupling subjected to step disturbance is also determined. The compensation scheme is presented in the frequency domain and is equivalent to the type 1 servo design in the time domain when the plant has no integrator.

Index-Terms: Decoupling, disturbance rejection, feedforward compensation ,multivariable control.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569117964

Time delay feedback control and chaotification of continuous dynamical systems

A. Ikhlef and N. Mansouri
University Mentouri of Constantine, Algeria

Abstract

Time-delayed feedback has been introduced as a powerful tool for control of unstable periodic orbits or control of unstable steady states. This paper addresses control and chaotification of continuous chaotic systems using time feedback control. Regarding the delay and the gain as parameters, we investigate the effect of choice those two parameters on the dynamics of the system. We first, consider the effect of gain and delay, then give several numerical simulations, which indicate that for certain values of time delay, a stable periodic orbit is converted into chaotic behavior.

Index-Terms: Chaotification, control, feedback, time delay

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569118674

Stable and highly efficient operation of open-loop controlled PM synchronous motor drive

Majid Al-Taee,[1] Hamzah AlZu'bi[2] and Monaf Al-Din[3]

[1] *University of Jordan, Jordan*

[2] *German-Jordanian University, Jordan*

[3] *Tafilah Technical University, Jordan*

Abstract

This paper investigates stability of a drive system incorporating a high-field PM synchronous motor with the aim of identifying a real-time stability index by means of an algorithm based on the Lyapunov method. Results from computer simulation show that the first principal minor (Minor-1) of the Lyapunov function has a distinct sign change in the region of interest. Such an important finding makes it possible to use Minor-1 as a real-time stability index. A computer controller based on the computed stability index is therefore suggested to drive the system at power factors closer to unity (*i.e.*, maximum efficiency), except if the constraints specified by Minor-1 dictate otherwise.

Index-Terms: Stability analysis, open loop control, permanent magnet machines, AC motor drives.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120729

A 2-sliding control for pneumatic artificial muscles

Mourad Chettouh,[1] Redouane Toumi[2] and Mustapha Hamerlain[3]

[1] *Université Saad Dahleb, Blida, Algeria*

[2] *USTHB, Algeria*

[3] *LRP/CDTA, Alger, Algeria*

Abstract

Pneumatic artificial rubber muscles (Parms) show similarity to biological muscles. A 2-sliding control technique is applied to the first two degrees of freedom of a robot actuated by such muscles. The Parms are arranged in opposite pair or antagonistic configuration. The objective is to show that without the use of the equivalent control, it is still possible to control the robot and at the same time reduce the chatter. Experimental results are presented.

Index-Terms: Artificial muscles, sliding mode, hosm, variable structure control

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569115938

Compensation of forces exerted over a short period applied to the robian biped robot trunk: simulations and experiments

C. Zaoui,[1] O. Bruneau,[2] F. B. Ouezdou[2] and A. Maalej[1]

[1] *Laboratory of Control and system dynamics, Tunisia*

[2] *LISV Engineering System Laboratory of Versailles, FRANCE*

Abstract

This paper deals with an analytical approach based on the inverse dynamic model to maintain the stability of the ROBIAN robot in the presence of external disturbances. The stabilization is carried out with a trunk having 4 degrees of freedom: three translations and one rotation. For a vertical posture of the robot, the trunk bodies of ROBIAN are used to compensate the external three-dimensional efforts applied to the robot. The first part of this study presents the simulation results of the dynamic behavior of the robot in the presence of external disturbances. During the simulation, this study enabled us to determine on-line the required movements and accelerations of the trunk parts necessary to maintain the stability of the robot. The proposed method was confirmed in a second phase of study through experiments for external force applied to ROBIAN for a short period.

Index-Terms: Bipedal robot, simulation of the dynamic behavior, stabilization.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569117288

Cyclic control of redundant robot under constraint with the self-motion method

M. Benzaoui and H. Chekireb
Laboratoire de Commande des Processus ENP, Algeria

Abstract

To meet the requirements due to the existing constraints in addition to the main task, it is possible to use, for the redundant robots, the self-motion (internal motion of joints). However, this solution can lead to a loss of the motion cyclicity in joints space. In this work, three methods are compared which ensure the conservation of the movement cyclicity. These latter are based respectively on the Lagrangian one (to improve selfmotion solution), a compliance function (to improve inverse jacobian solution) and the last is a combination of both methods. We consider the control of a redundant robot which carries out a trajectory tacking in operational space with the constraints due to the position and velocity limits of joints. Also, the proposed methods are tested in the case of the 3 DOF planar robots deduced from the PUMA 560. The obtained results show that the two methods alone can ensure the motion cyclicity meanwhile the combined method is more efficient.

Index-Terms: Redundant robots, robots control under constraints, self-motion, cyclic motion conservation.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569117412

Dynamic redundancy resolution for mobile manipulators with joints velocity limits avoidance

M. Jallouli,[1] M. Boukattaya[1] and T. Damak,[2]

[1] *Intelligent Control Design and Optimization of Complex Systems, Engineering School of Sfax, Tunisia*

[2] *Unité de Commande de Procédés Industriels, Engineering School of Sfax, Tunisia*

Abstract

In this paper, we present a dynamic redundancy resolution technique for mobile manipulator subject to joint velocity limits. First, the dynamic model of the mobile manipulator in feasible motion space is given. Next, a control algorithm is proposed which completely decouples the motion of the system into the end-effector motion in the task space and the internal motion in the null space and controls them in prioritized basis with priority given to the primary task space and enables the selection of characteristics in both subspaces separately. A special attention is given to the joints velocity limits avoidance where a normalized measure is proposed to solve problems inherent to velocity limits of the system. Simulation results are given to illustrate the coordination of two subsystems in executing the desired trajectory without violating the joint velocity limits.

Index-Terms: mobile manipulators, dynamic redundancy resolution, velocity limits, task space, null space.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569118682

Real time localization of a mobile robot using webcam data

Lobna Amouri-Jmaiel, Mohamed Jallouli and Nabil Derbel
ICOS, Ecole Nationale d'Ingénieurs de Sfax, Tunisia

Abstract

Localization is one of the most important functions for the mobile robot navigation. Most of previous position estimation methods calculate current position and orientation of mobile robot by applying various localization schemes with the information obtained from internal sensors which are set on the mobile robot, or by recognizing an artificial landmark attached on the wall. Several drawbacks about them have been brought up. To avoid these inconvenient, a new localization method that calculate in real time the absolute position of the mobile robot by using external camera fixed on the ceiling in the indoor environment is proposed. Besides, this approach provide a low expensive solution using a Webcam. This scheme is an absolute position estimation which can decrease the position error by applying filtering and adaptive algorithms (Extended Kalman Filter adapted with Fuzzy Logic). The effectiveness of the proposed localization algorithm is demonstrated through the experiments.

Index-Terms: Real time localization,webcamdata, mobile robot navigation, object segmentation.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120733

Variable structure control for set-point stabilization of 2-DOF underactuated manipulators

Sonia Mahjoub,,[1] Faical Mnif,[1,2] and Nabil Derbel,[1]

[1] *Ecole Nationale d'Ingénieurs de Sfax, Tunisia*

[2] *Department of Electrical and Computer Engineering Sultan Qaboos University,Muscat, Oman*

Abstract

Controlling an underactuated manipulator with less actuators than degree of freedom is a challenging problem, specifically when it is to force the underactuated manipulator to track a given trajectory or to be configured at a specific position in the work space. This paper presents a cascade sliding mode tracking controller for set-point regulation of 2-DOF underactuated manipulators. This work builds on an observation that an underactuated manipulator can be treated as two subsystems. Consequently, a cascade sliding mode tracking controller can be designed as follows. First, a sliding mode surface is designed for both subsystems, this two sliding surfaces represent a first layer in the design architecture. A second layer sliding mode surface is then constructed based on the first layer sliding surface. The cascaded sliding mode controller is therefor deduced in terms of Lyapunov stability theorem. Robustness issues to bounded disturbances are then investigated. Simulation results on 2-DOF whiling pendulum are presented to demonstrate the effectiveness of the approach.

Index-Terms: VSS, sliding mode, underactuated manipulator, whiling pendulum

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569115011

Polynomial approximations and convergence rate of Mamdani fuzzy controllers

Jean-Yves Dieulot,[1] Nawel Aoun,[1,2] Mohamed Benrejeb[2] and Pierre Borne[1]

[1] *Ecole Centrale de Lille, France*

[2] *Ecole Nationale d'Ingénieurs de Tunis, Tunisia*

Abstract

The analytical expression of a fuzzy controller has been studied when the output fuzzy membership functions are equally spaced and triangular or trapezoidal. The cases, when a fuzzy set of the output is extreme - with respect to the universe of discourse - or not extreme have been considered. When considering extreme sets, the controller can be approximated with a good precision by a second-degree polynomial and, in the contrary, by a first-degree polynomial. The modelling of the output by a second-degree multivariable polynomial has been shown to affect strongly the convergence rate, which is enlightened by an example for which the closed-loop stability is not exponential.

Index-Terms: Stability, polynomial approximation, non-exponential convergence, fuzzy control, continuous systems

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569115943

A multi-agent predictive control approach based on fuzzy supervisory loop for fast dynamic systems

Hichem Ben Nasr[1] and Faouzi M'Sahli[2]

[1] *Institut Supérieur des Etudes Technologiques de Sfax, Tunisia*

[2] *Ecole Nationale d'Ingénieurs de Monastir, Tunisia*

Abstract

In this paper, a new approach based on the multi-agent concept is proposed for model predictive control (MAMPC) of a nonlinear fast dynamic system. This concept achieves a transformation of the centralized MBPC in a decentralized and supervised technique. The control of the nonlinear system subject to constraints is achieved via a set of actions taken from different agents. The actions are based on an analytical solution and a fuzzy supervision is used to monitor the closed system using a supervisory loop concept. These strategies of control permits to unlock the obstacle met by the MBPC dedicated to the oscillating and fast dynamic systems and facilitate their real time implantation. The multi-agent compares favorably with respect to a numerical optimization procedure and offers a solution for non convex optimization. A simulation example shows the fast execution of the proposed concept compared to conventional procedure.

Index-Terms: multi-agent, predictive control, fast dynamic system, constraints, fuzzy supervisor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569119055

Comparison of linear and nonlinear H_∞ control for a permanent magnet synchronous motor

Safia Yousfi,[1] Said Djennoune[2] and Maamar Bettayeb[3]

[1] *University of Tizi ouzou, Algeria*

[2] *Laboratoire de conception et conduite de systèmes de productique, Algeria*

[3] *University of Sharjah, UAE*

Abstract

The objective of this paper is to design linear and nonlinear H_∞ controllers, and compared it. For linear systems, the H_∞ controller is obtained by solving Riccati equations using iterative procedures or by linear matrix inequalities. However, for nonlinear systems, the task is more complicated. In the particular case of nonlinear affine-input systems, the solution of the H_∞ control problem is derived from the Hamilton-Jacobi Equations (HJE). The exact explicit solutions of this type of equations are, in general, unknown or hard to compute. Approximate solutions are obtained from a successive procedure. In this paper, we propose a nonlinear matrix inequalities approach to design a nonlinear H_∞ controller. Simulations of the closed-loop synchronous motors responses for both nonlinear and linear H_∞ controllers will be performed and compared. It is found that the nonlinear H_∞ controller has better performances and robustness than the linear controller.

Index-Terms: Robust control, linear and nonlinear $\mathcal{H}_\infty$ control, dissipative systems, synchronous motor.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569119680

An improved LMI approach for robust static output feedback stabilization of nonlinear systems

Neila Bedioui, Salah Salhi and Mekki Ksouri
LACS, Ecole Nationale d'Ingénieurs de Tunis, Tunisia

Abstract

This paper deals with the problem of robust stability for a class of nonlinear systems. The systems are composed of a linear constant part perturbed by an additive nonlinear function which satisfies a quadratic constraint. A new sufficient condition, formulated in terms of linear matrix inequality LMI, is presented for static output feedback stabilization. Numerical examples are given to illustrate the effectiveness of the proposed design methods.

Index-Terms: nonlinear systems, Lyapunov function, stability, static output feedback synthesis, LMI.

International Multi-Conference
on Systems, Signals & Devices
July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-1569120728

Adaptive type-2 fuzzy control for induction motor

Kheireddine Chafaa,[1] Yahia Laamari,[2] Said Barkati[2] and Souad Chaouch[2]

[1] *Electronics Department, University of Mohamed Boudiaf, 28000, M'sila, Algeria*

[2] *Electromechanics Department, University of Mohamed Boudiaf, 28000, M'sila, Algeria*

Abstract

This paper proposes a new indirect adaptive fuzzy controller based on interval type-2 fuzzy logic systems for indirect vector-controlled induction motor drive. Type-2 fuzzy controller compared with type-1 fuzzy controller, has the advantage that it can take into account the linguistic uncertainties present in the rules of the estimated models. The proposed control scheme consists of a combination of two controllers: a type-2 fuzzy controller and a supervisory controller. The supervisory controller is used when the system loop tend to be unstable. The tuning parameters for the type-2 fuzzy controller will change according to some learning algorithms based on Lyapunov theorem.

Index-Terms: Type-2 fuzzy logic, fuzzy control, adaptive control, induction motor, control vector.

Author Index