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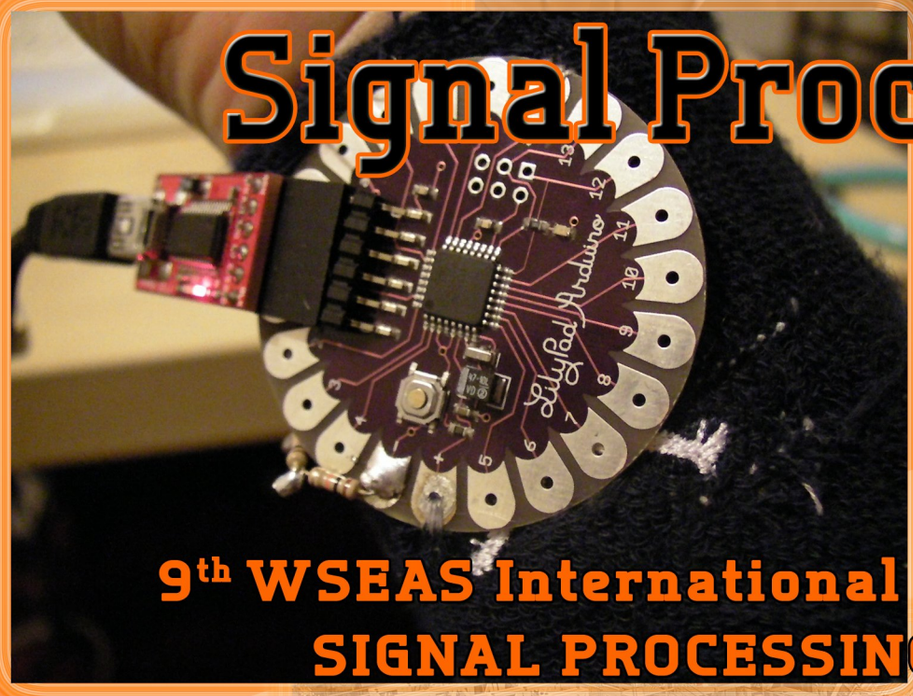
New Aspects of Signal Processing



9th WSEAS International Conference on SIGNAL PROCESSING (SIP '10)

Catania, Italy, May 29-31, 2010

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Electrical and Computer Engineering Series
A Series of Reference Books and Textbooks

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Preface

This year the 9th WSEAS International Conference on SIGNAL PROCESSING (SIP '10) was held in Catania, Italy, May 29-31, 2010. The conference remains faithful to its original idea of providing a platform to discuss filter design and structures, fast algorithms, array signal processing, statistical signal analysis, psychoacoustics, broadband audio coding, multidimensional systems, computed imaging, geophysical and seismic processing, pattern recognition, evolutionary computation, programmable signal processors, biomedical processing, remote sensing, robotics, astronomy, satellite signals processing etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

A New Method for the Lubrication of Mechanical Systems by Means Spray Technology

Professor Vincenzo Niola
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Abstract: The spray for industrial use are largely developed and optimized in order to have a perfect atomization. The process of atomization is well explained in literature. It is strongly governed by Weber number. This parameter is defined like the ratio between the kinetic energy related to the axial velocity to the surface tension, giving a threshold of the start up of the atomization phenomenon.
The nozzle design and the fluid characteristics, that are involved in the atomization process. The Weber number depends on the square axial velocity of the jet. In many cases, the quadratic dependence on the exit velocity is a limitation for droplets breakup. Today, the fuel injectors have a high capability of atomization by means of high pressure and high exit velocity. The high axial velocity inside a diesel engine , e.g. can impact on the surface of the cylinder before of the combustion phenomenon. In this paper we study how the spray technology can be use in to a gear box lubrication or in general in a kinematic pair. The lubricant film has to be put between the two surfaces of the kinematic pair to ensure proper lubrication. The growth of a thin lubrication film in this case is a function of the coalescence and the speed of drop impact. Not always too high-speed are able to ensure an uniform lubricant film. In the tribology field the high-speed can cause phenomena of instability of the lubricant film. In many industrial applications it is interesting to have atomization with low output speed, In this work an atomiser pressure-swirl for the atomization of fuel oil, is studied to oil lubricants applications. The aim of the paper is to compare the design t parameters of the industrial nozzle le (pressure, density, temperature, etc.) that are sufficient for proper atomization, with parameters that governs the phenomenon of atomization. The first results of this research show how the pressure-swirl atomizer has an output rate lower than that obtained by imposing the critical Weber. The atomization diagnostic of a pressure swirl has to be studied by other parameters than minimum Weber number above which there is atomization.

Brief Biography of the Speaker:
Vincenzo Niola is professor of Applied Mechanics at Naples University Federico II since 31 march 1987. After he got an Univerisity Degree in Mechanical Engineering, he started in january 1978 didactics activity as helper at course of Applied Mechanics and Machines et as member of their committee of examination. Since september 1979 he carried on that collaboration as owner of a scholarship from C.N.R. (National Research Council). Since december 1981 to march 1987 he was a researcher carrying on the practice course for Applied Mechanics, taking a part at examination meeting and working as proposer in many degree thesis. Since 1981 to 1984 he carried on his didactics activity as university teacher for Bioengineering course of locomotive apparatus at Orthopaedy and Traumathology specialization school of 2th Department of Medicine and Surgery of Naples University. Since 31 March 1987 is professor of Applied Mechanics at Naples University Federico II, and since A.A. 86/87 to A.A. 92/93 he carried on the Applied Mechanics and Machines course for electronic engineers, and since A.A. 93/94 to today carry on the Applied Mechanics course for computer science engineers. Since A.A. 88/89 to 89/90 he carried on as supply teacher the Applied Mechanics course for building engineers at Salerno Engineering University. By A.A. 94/95 to A.A. 97/98 he carried on as supply professor Tribology course at Naples University Federico II. By A.A. 2001/2002 he holds the chair of Applied Mechanics for University Degree of "Orthopaedic Technician" at 2th Department of Medicine and Surgery of Naples University. Since A.A. 2005/2006 is professor of Tribology and of Complements of Mechanics. During this years Prof. Vincenzo Niola has been the chairman of his courses examination meetings, and was proposer of many degree thesis.. During his activity Prof. Vincenzo Niola was owner of financings from MURST and (in past and present) cooperate scientifically with research corporation and national industries (MERISINTER, MONTEFLUOS, INDESIT, ALENIA, C.I.R.A.). He's scientific member of Naples research unit for PRIN 2003. He's fellow of Italian Association of Theoretical and Applied Mechanics (AIMETA). He's member of IFToMM Linkages on cams committee. He belongs to the International Scientific Committee of the "World Scientific and Engineering Academy and Society (WSEAS). He is President of the WSEAS Italy Chapter on the "Analysis of the Mechanical Systems". He was been Chairman and "invited author" in some session of Internatinal Conferences. He's author of more than 130 national and international papers.

Plenary Lecture 2

Image Processing in Personal Identification

Professor Ryszard S. Choras
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Abstract: A biometric system is a pattern recognition system that recognizes a person on the basis of a feature vector derived from a specific physiological or behavioral characteristic that the person possesses.
All biometric systems work in a similar fashion:
-The user submits a sample that is an identifiable, unprocessed image or recording of the physiological or behavioral biometric via an acquisition device,
-This image and/or biometric is processed to extract information about distinctive features.
Biometric systems have four main components: sensor, feature extraction, biometric database, matching-score and decision-making modules. The input subsystem consists of a special sensor needed to acquire the biometric signal. Invariant features are extracted from the signal for representation purposes in the feature extraction subsystem. During the enrollment process, a representation (called template) of the biometrics in terms of these features is stored in the system. The matching subsystem accepts query and reference templates and returns the degree of match or mismatch as a score , i.e., a similarity measure. A final decision step compares the score to a decision threshold to deem the comparison a match or non-match.
Automated biometrics-based personal identification systems can be classified into two main categories: identification and verification.
The personal attributes used in a biometric identification system can be physiological, such as facial features, fingerprints, iris, retinal scans, hand and finger geometry; or behavioral, the traits idiosyncratic of the individual, such as voice print, gait, signature, and keystroking.
In this paper a recognition methods are presented for recognizes a person on the basis of a feature vector derived from a facial, fingerprints, palmprints, hand, iris and retina input images.

Brief Biography of the Speaker:
Ryszard S. Choras, He is currently Full Professor in the Institute of Telecommunications of the University of Technology & Life Sciences,
Bydgoszcz, Poland. His research experience covers image processing and analysis, image coding, feature extraction and computer vision.
At present, he is working in the field of image retrieval and indexing, mainly in low- and high-level features extraction and knowledge extraction in CBIR systems. He is the author of Computer Vision. Methods of Image Interpretation and Identification (2005) and more than 163 articles in journals and conference proceedings.
He is the member of the Polish Cybernetical Society, Polish Neural Networks Society, IASTED, and the Polish Image Processing Association. Professor Choras is a member of the editorial boards of Machine Vision and Graphics, International Journal of Biometrics (IJBM), International Journal of Biology and Biomedical Engineering, Recent Patents On Signal Processing (Bentham Open). He is the editor-in-chief of Image Processing and Communications and associate editor-in-chief Computer Science Journals (CSC Journals) Image Processing (IJIP).
He has served on numerous conference committees, e.g., as Visualization, Imaging, and Image Processing (VIIP) , IASTED International Conference on Signal Processing, Pattern Recognition and Applications (SPPRA) and International Conference on Computer Vision and Graphics in Warsaw, ICINCO\ICATE Conference.

Plenary Lecture 3

Discrete-Time Optimal and Unbiased FIR Estimation of State Space Models

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Abstract: Optimal estimation of signal parameters and system models is often required to formalize a posteriori knowledge about undergoing processes in the presence of noise. Therefore, filtering, smoothing, and prediction have become key tools of statistical signal, image, and speech processing and found applications in algorithms of various electronic systems. Very often, estimation is provided using methods of linear optimal filtering employing either finite impulse response (FIR) or infinite impulse response (IIR) structures. First fundamental works on discrete-time optimal linear filtering of stationary random processes were published in 1939-1941 by Kolmogorov as mathematically-oriented. Soon after, Wiener solved the problem for engineering applications in continuous-time and Levinson used the Wiener error criterion in filter design and prediction. The solutions by Wiener were all in the frequency domain, presuming IIR solutions. A FIR modification to the Wiener filter was made by Zadeh and Ragazzini. Thereafter, Johnson extended Zadeh-Ragazzini's results to discrete time. The roots of optimal FIR filtering can be found namely in these basic works. Despite the inherent bounded input/bounded output stability and robustness against temporary model uncertainties and round-off errors, practical interest to FIR filtering weakened after Kalman and Bucy presented in 1960-1961 complete results on the theory of linear filtering of nonstationary Gaussian processes. In contrast to the FIR solutions implying large computational burden and memory, the recursive IIR Kalman-Bucy algorithm has appeared to be simple, accurate, and fast. That has generated an enormous number of papers devoted to the investigation and application of this filter. It then has been shown that the Kalman filter is a nice solution if the model is distinct, there are no uncertainties, and noise sources are all white sequences. Otherwise, the algorithm may become unstable and its estimate may diverge. An interest to FIR structures has grown in recent decades owing to a dramatic development in computational resources. In receding horizon predictive control, significant results on optimal linear FIR filtering of Gaussian processes have been achieved by Jazwinski, Liu and Liu, Ling and Lim, and Kwon et al. For image processing, predictive FIR filtering has been proposed by Heinonen and Neuvo and thereafter developed by many authors. For polynomial models, FIR structures were used by Wang to design a nonlinear filter, by Zhou and Wang in the FIR-median hybrid filters, and a number of publications keep growing.

In this presentation, we show that the general theory of the p-shift optimal linear FIR estimator follows straightforwardly from the real-time state space model (from n and n-1 to n) used in signal processing, rather than from the prediction model (from n to n+1) used in control. This model allows for a universal estimator intended for solving the problems of filtering ($p = 0$), prediction ($p > 0$), and smoothing ($p < 0$) in discrete-time and state space on a horizon of N points. In such an estimator, the initial state is self-determined by solving the discrete algebraic Riccati equation (DARE). The noise components are allowed to have arbitrary distribution and covariance functions with a particular case of white Gaussian approximation. Depending on p, the estimator is readily modified to solve several specific problems, such as the receding horizon control one ($p = 1$), smoothing the initial state ($p = ?N+1$), holdover in digital communication networks ($p > 0$), etc. We show that the optimal FIR estimator gain is a product of the unbiased gain and the noise-dependent function composed with the covariance functions and the initial state function. An important point is that the optimal and unbiased estimates converge either when the convolution length is large, $N >> 1$, or if the initial state error dominates the noise components. The unbiased (near optimal) FIR estimate associated with the best linear unbiased estimator (BLUE) is considered in detail as having strong engineering features. Along with the noise power gain (NPG), this estimate can be represented in batch and recursive Kalman-like forms. A special attention is paid to the polynomial state space models as being basic for many applications. For this model, the unique low-degree polynomial gains are derived and investigated in detail. Applications are given for polynomial state space modeling, clock state estimation and synchronization, and image processing. The trade-off with the Kalman algorithm is also discussed and supported with experimental results.

Brief Biography of the Speaker:

Professor Yuriy S. Shmaliy is a Full Professor of Electronics of the School of Mechanical, Electrical, and Electronic Engineering (FIMEE) of the University of Guanajuato, Mexico. He received the B.S., M.S., and Ph.D. degrees in 1974, 1976 and 1982, respectively, from the Kharkiv Aviation Institute, Ukraine, all in Electrical Engineering. In 1992 he received the Doctor of Technical Sc. degree from the Kharkiv Railroad Institute. In March 1985, he joined the Kharkiv Military University. He serves as Full Professor beginning in 1986. Since 1999 to 2009, he has been with the Kharkiv National University of Radio Electronics.

Prof. Shmaliy has 250 Journal and Conference papers and 80 patents. His books Continuous-Time Signals (2006) and Continuous-Time Systems (2007) were published by Springer. His book GPS-Based Optimal FIR Filtering of Clock Models (2009) was published by Nova Science Publ., New York. He also contributed with several invited Chapters to books. He was rewarded a title, Honorary Radio Engineer of the USSR, in 1991. He was listed in Marquis Who's Who in the World in 1998; Outstanding People of the 20th Century, Cambridge, England in 1999; and Contemporary Who's Who, American Bibliographical Institute, in 2002. He is a Senior Member of IEEE. He has Certificates of Recognition and Appreciation from the IEEE, WSEAS, and IASTED. He serves as an Associate Editor in Recent Patents on Space Technology. He is a member of several Organizing and Program Committees of Int. Symposia. He organized and chaired several International Conferences on Precision Oscillations in Electronics and Optics. He was multiply invited to give tutorial, seminar, and plenary lectures. His current interests include optimal estimation, statistical signal processing, and stochastic system theory.

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