



ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

**Área Científica de Engenharia de Electrónica e
Telecomunicações e de Computadores**



ANUÁRIO
2003

Lisboa

MECHANISM OF FERROMAGNETISM IN DILUTED MAGNETIC SEMICONDUCTORS AT LOW CARRIER DENSITY

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Publicado em: *JOURNAL OF SUPERCONDUCTIVITY* 16 (1): 67-70
FEB 2003

We analyze critical temperature of ferromagnetic ordering in diluted magnetic semiconductors in the mean-field approximation. Using a general field-theoretical approach we formulate a description of magnetic phase transition, which takes into account the interaction of magnetic fluctuations. We also propose a mechanism of exchange interaction between Mn impurity moments in GaMnAs alloys via the Mn-induced acceptor levels. This mechanism may lead to low temperature ferromagnetism at vanishing concentration of free carriers.

NON PIXELLED AMORPHOUS SILICON BASED COLOR SENSORS.

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Publicado em: *Physics E. 16/3-4 (2003) pp.563-567.*

In recent works large area hydrogenated amorphous silicon p-i-n structures with low conductivity doped layers were proposed as single element image sensors. The working principle of this type of sensor is based on the modulation, by the local illumination conditions, of the photocurrent generated by a light beam scanning the active area of the device. In order to evaluate the sensor capabilities is necessary to perform a response time characterization. This work focuses on the transient response of such sensor and on the influence of the carbon contents of the doped layers. In order to evaluate the response time a set of devices with different percentage of carbon incorporation in the doped layers is analyzed by measuring the scanner-induced photocurrent under different bias conditions.

**HIGH SENSITIVE IMAGE SENSORS BASED ON A TANDEM LASER
SCANNED PHOTODIODE**

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Publicado em: *Proc. of II International Materials Symposium, (Lisbon, Portugal, April 14-16, 2003)*
Advanced Mateial Forum II, 91-95 (2003).

A new design based on a stacked n-i-p-n-i-p heterojunction is proposed for the Colour Laser Scanned Photodiode image sensor and compared with performance presented by a sensor whose capture element is based on a single p-i-n structure. Results show that the double structure presents a higher light-to-dark sensitivity. A black and white image is acquired with an improved resolution when compared with the single structure. The readout frequency is optimized showing that scans speeds up to 10^4 lines per second can be achieved without degradation in the resolution. A physical model is presented and supported by an electrical and a numerical simulation of the output characteristics of the sensor.

A-SiC:H TANDEM SOLAR CELLS: A NUMERICAL SIMULATION.

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Publicado em: *Proc. of II International Materials Symposium, (Lisbon, Portugal, April 14-16, 2003)*
Advanced Mateial Forum II, (2003).

Stacked a-Si:H pin/pin diodes are known to be more stable with respect to the light induced degradation than the conventional single junction pin structure. This can be ascribed to a better internal electric field distribution leading to an improved drift transport mechanism within the intrinsic layers. However the device performance can be limited by the reverted field associated with the internal n-p interface region (recombination junction). Such a different built-in field configuration leads to a device functioning fundamentally different from the standard p-i-n device, which can be well described through a detailed analysis of the internal electrical configuration of the device.

We present a study based on a numerical simulation about the behaviour of an a-SiC:H pin/ a-Si:H pin monolithic tandem solar cell and we compare them with the characteristics of a tandem solar cell with the same characteristics produced by rf PE-CVD. Junction properties, carrier transport, photogeneration and collection efficiency are investigated from dark and illuminated current-voltage characteristics and spectral response measurements, with and without additional background illumination and under different light bias conditions.

STACKED A-SIC:H OPTICAL TRANSDUCERS: THE INFLUENCE OF THE SENSING MATERIAL

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Publicado em: *Proc. of II International Materials Symposium, (Lisbon, Portugal, April 14-16, 2003)*
Advanced Mateial Forum II, 81-85, 2003.

The efforts are focused mainly on doped n- and p-type layers at high and low doping levels with and without carbon, as well as in the intrinsic layer thickness and composition. The structural and optoelectronic properties of the single layers were determined through infrared and visible spectroscopy, temperature-dependent conductivity, and were complemented by CPM measurements. Junction properties, carrier transport, photogeneration and collection efficiency are investigated from dark and illuminated current-voltage characteristics and spectral response measurements, with and without additional background illumination and under different light bias conditions.

Results show that the collection efficiency depends strongly on the structure of the device (single or stacked).

The obtained results show that an accurate engineering of the interfaces, in terms of optical gap and band-bending control can improve collection efficiency, showing that the interface band banding can be managed to create a monolithic tandem solar cell working almost as two cells connected in series. The importance of a well balanced photogeneration between the two sub-cells has also been outlined, aiming to indicate the need to determine an optimal configuration of the absorber layers (in terms of optical gap and thickness) so advantage can be taken of local fields created by band discontinuities at the internal n/p interface.

A-SiC:H TANDEM SOLAR CELLS: CHARACTERIZATION AND NUMERICAL SIMULATION

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Publicado em: *Proc. of European Materials Research Society Symposium, (Strasburg, France, 10-13, June, 2003) Sensor and Actuators (in press).*

Stacked a-Si:H p-i-n/p-i-n diodes are known to be more stable with respect to the light induced degradation than the conventional single junction p-i-n structure. We present a study, based on a numerical simulation, about the internal behavior of an a-SiC:H pin/ a-Si:H pin monolithic tandem solar cell. The results we show that an accurate engineering of the internal n/p interface, in terms of optical gap and band banding control can improve the solar cell efficiency, showing that the interface band bending can be managed to create a monolithic tandem solar cell working almost as two cell connected in series. The importance of a well balanced photogeneration between the two sub-cells has been also outlined, aiming to indicate the need to determine an optimal configuration of the absorber layers (optical gap and thickness) in order to take profit from the local fields created by the band discontinuities at the internal n/p interface.

LARGE AREA IMAGE SENSING STRUCTURES BASED ON A-SIC:H : A DYNAMIC CHARACTERIZATION

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Publicado em: *Proc. of European Materials Research Society Symposium, (Strasburg, France, 10-13, June, 2003) Sensor and Actuators (in press).*

In recent works large area hydrogenated amorphous silicon p-i-n structures with low conductivity doped layers were proposed as single element image sensors. The working principle of this type of sensor is based on the modulation, by the local illumination conditions, of the photocurrent generated by a light beam scanning the active area of the device. In order to evaluate the sensor capabilities is necessary to perform a response time characterization. This work focuses on the transient response of such sensor and on the influence of the carbon contents of the doped layers. In order to evaluate the response time a set of devices with different percentage of carbon incorporation in the doped layers is analyzed by measuring the scanner-induced photocurrent under different bias conditions.

OPTICAL CONFINEMENT AND COLOUR SEPARATION IN A DOUBLE
COLOUR LASER SCANNED PHOTODIODE (D/CLSP)

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Publicado em: *Proc. Transducers 2003, (Boston Massachusetts, USA, 8-12, June, 2003). Sensor and Actuators (in press).*

Large area n-i-p-n-i-p a-SiC:H heterostructures are used as sensing element in a Double Color Laser Scanned Photodiode image sensor (D/CLSP).

This work aims to clarify possible improvements, physical limits and performance of CLSP image sensor when used as non-pixel image reader. Here, the image capture device and the scanning reader are optimized and the effects of the sensor structure on the output characteristics discussed.

The role of the design of the sensing element, the doped layer composition and thickness, the read-out parameters (applied voltage and scanner frequency) on the image acquisition and the color detection process are analyzed.

A physical model is presented and supported by a numerical simulation of the output characteristics of the sensor.

STACKED PIN-PIN HETEROJUNCTIONS FOR IMAGE RECOGNITION AND COULOR SEPARATION

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Publicado em: *Amorphous and heterogeneous silicon based films-2002, (S. Francisco, April 21-25 USA), Mat. Res. Soc. Symp. Proc 762@2003 A.18.13.1*

A new design based on a stacked n-i-p-n-i-p structure is proposed for the Colour Laser Scanned Photodiode sensor, CLSP. The CLSP is a two terminal sensor based on one single large area p-i-n sensing element and a scanning reader. In short circuit mode, it can detect a black and white image. Under forward bias, colour separation is possible, with a reasonable rejection rate. No optical filters are used during the image acquisition process.

To tune the spectral sensitivity of the device we propose a stacked metal/nipnip/metal sensing element. The first p-i-n photodiode confines the carriers at the illuminated regions while the second one, driven by the scanner, gives information on their location (image shape) density (image intensity) and absorbed wavelength (image colour). In this work the efforts are focused mainly on the design of the structure and composition of the layers and its role on sensor performance.

**PHOTOCURRENT PROFILE IN A-SI:H TANDEM STRUCTURES:
DEPENDENCE ON THE ILLUMINATION CONDITIONS.**

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Publicado em: *Proc. of International conference on amorphous and microcrystalline semiconductors: Science and Technology, (Campos do Jordão SP, Brazil, August 25-29, 2003).* *J. Non Cryst. Solids (in press)*

We present in this paper results about the analysis of the photocurrent in a-Si:H tandem structures. It is well known in literature that, in order to optimize the light power conversion, the geometry of the cell and the thickness of the absorber layers must be adjusted to the light absorption profile. If there is a mismatch between the number of the electron-hole pairs generated in the sub-cells, the total collected current is limited by the sub-cell absorbing the lowest number of photons. We have found the photocurrent profile in these conditions to be dependent on the light absorption profile, that is, on the incident light wavelength and intensity. Our experiments and analysis reveal the photocurrent profile to have a strong nonlinear dependence on the externally applied bias in the range around to the open circuit value, indicating the superposition of different, concurring effects that lead the photocurrent to alternatively increase and decrease before finally entering in its secondary state.

Our interpretation point out the cause of such effect to a self biasing of the bottom cell under certain unbalanced light generation of carriers and an asymmetric reaction of the internal electric fields to the externally imposed forward bias. The possibility to relate such a behavior to the light intensity and color, leave an open discussion on the possibility to use these structures and this effect for color recognition sensors. We present in this paper results about the experimental characterization of the photocurrent, numerical simulations with the

program ASCA, curve fitting of the experimental data, and SPICE simulations based on the proposed equivalent model.

OPTICALLY ADDRESSED READ-WRITE DEVICE BASED ON A TANDEM HETEROSTRUCTURES

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Publicado em: *Proc. of International conference on amorphous and microcrystalline semiconductors: Science and Technology, (Campos do Jordão SP, Brazil, August 25-29, 2003).* *J. Non Cryst. Solids (in press)*

An optically addressed read-write sensor based on two stacked p-i-n heterojunctions is analyzed. The device is a two terminal image sensing structure. The charge packets are injected optically into the p-i-n writer and confined at the illuminated regions changing locally the electrical field profile across the p-i-n reader. An optical scanner is used for charge readout.

The role of the sensor configuration and readout parameters on the image acquisition process is analyzed. The presence of a metallic light-screening layer between the writer and the reader proved to be effective to optically decouple the two p-i-n structures, while maintaining good electrical conductivity. The optical-to-electrical transfer characteristics show high quantum efficiency, broad spectral response, and reciprocity between light and image signal. A numerical simulation supports the imaging process.

OPTOELECTRONIC CHARACTERIZATION OF A-SIC:H STACKED DEVICES

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Publicado em: *Proc. of International conference on amorphous and microcrystalline semiconductors: Science and Technology, (Campos do Jordão SP, Brazil, August 25-29, 2003).* *J. Non Cryst. Solids (in press)*

The aim of this work is the optoelectronic characterization of double p-i-n stacked devices based on a-Si alloys materials, in order to evaluate their suitability in large area optical sensors.

Photogeneration, collection efficiency and carrier transport are investigated from dark and illuminated current-voltage characteristics and spectral response measurements, with and without additional background illumination and different electrical bias conditions.

Results show that the collection efficiency depends on the device configuration and on the optical and electrical bias. The carrier collection is mainly dependent on the front and back intrinsic layers thickness and on the composition of the p-type doped layers. When wide band gap p-layers are used, the asymmetric distribution of the electrical field controls the transport mechanism. Under red optical bias the electrical field is enhanced at the front cell and decreased at the back one leading to an increased red light-to-dark sensitivity.

A numerical simulation supports the discussion of the experimental results. Considerations about induced electric field and inversion layers at the interfaces and generation-recombination process are used to explain the devices output.

NOVEL STRUCTURE FOR LARGE AREA IMAGE SENSING

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Publicado em: *Proc. 17th European Conference on Solid-State Transducers “Euroensors XVII”, Guimaraes, Portugal, September 21 –Sensor and Actuators (in press).*

This work presents preliminary results in the study of a novel structure for a Laser Scanned Photodiode (LSP) type of image sensor. In order to increase the signal output, a stacked n-i-p-n-i-p structure with an intermediate light blocking layer. The image and scanner are absorbed in separated junctions; the device photocurrent is dependent on the local illumination conditions on the image side junction. The results show that the structure can be successfully used as an image sensor even though some optimization is needed to enhance the performance of the device.

A NON-PIXEL IMAGE READER FOR CONTINUOUS IMAGE DETECTION BASED ON TANDEM HETEROSTRUCTURES

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Publicado em: *Proc. 17th European Conference on Solid-State Transducers "Euroensors XVII", Guimaraes, Portugal, September 21 –Sensor and Actuators (in press).*

Large area stacked n-i-p(a-Si:H)/n-i-p(a-SiC:H) heterostructures are used as Colour Laser Scanned Photodiode image sensors. The sensor consists on one large cell sensing element and an optical scanner. The design allows a continuous readout without the need for pixel-level patterning. The role of light pattern and scanner wavelengths on the readout parameters is analyzed. To avoid image smearing, a significant improvement is achieved by confining the carriers generated by the light pattern at the back photodetector and the ones generated by the scanner at front reader. Results show that the highest resolution and contrast is achieved with a green light pattern and a blue scanner. A black and white image is acquired with a resolution around 20 μm showing the potentiality of these devices for imaging applications. The readout frequency is optimized showing that the scan speed can go up to 104 lines per second without degradation in the resolution. Electrical and numerical simulations support the results.

FERROMAGNETISM IN DILUTED MAGNETIC SEMICONDUCTORS AT LOW CARRIER DENSITY

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Publicado em: *PHYSICA STATUS SOLIDI B-BASIC RESEARCH*, 236 (2): 507-510 MAR 2003

We present a general approach to the problem of a ferromagnetic phase transition in diluted magnetic semiconductors with free carriers. The Curie temperature of ferromagnetic transition is calculated in the mean field approximation. The approach allows to analyze the effects of magnetic fluctuations and disorder on the Curie temperature. We also propose a new mechanism of exchange interaction between magnetic impurities at vanishing concentration of free carriers.

MODELING OF MAGNETICALLY CONTROLLED SI-BASED OPTOELECTRONIC DEVICES

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Publicado em: *PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES 16 (3-4): 558-562 MAR 2003*

We present a theoretical analysis and results of modeling of a new integrated device for spintronics application, which is based on a hybrid metal-semiconductor structure. The proposed device consists of a Si-based p-i-n photodetector sandwiched between two layers of a ferromagnetic metal (3d ferromagnet or half-metallic compound). Electron-hole pairs are created in the semiconductor part of the structure by light illumination. The photocurrent flowing in such a system is shown to depend on its magnetic configuration. This is due to a difference in the specular reflection (as well as in the diffuse scattering) of spin-up and spin-down electrons and holes from magnetically polarized layers-similar to giant magnetoresistance effect in magnetic multilayers. This, in turn, allows controlling the device performance by an externally applied magnetic field. We have estimated magnitude of the effect and also determined the role of relevant material parameters.

EXCHANGE INTERACTION AND FERROMAGNETISM IN III-V SEMICONDUCTORS

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Publicado em: *PHYSICAL REVIEW B* 67 (3): Art. No. 033201 JAN 15 2003

The mechanism of indirect exchange interaction leading to ferromagnetism in magnetically doped III-V semiconductors is considered theoretically. The mechanism is based on the interplay of two interactions: (i) hybridization of band states with shallow impurity ones, and (ii) direct exchange coupling between localized spins and the band states. The indirect exchange interaction between two Mn impurities occurs when the wave functions of shallow states associated with the Mn atoms overlap. The mechanism does not rely on degenerate carriers, and therefore can describe the ferromagnetic transition in both degenerate and nondegenerate semiconductors. Ferromagnetic critical temperature has been calculated within the percolation approach, and is in good agreement with available experimental data.

OPTICAL PROPERTIES AND TRANSPORT IN PLD-GAN

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Publicado em: *SOLID-STATE ELECTRONICS* 47 (3): 569-573 MAR 2003

We present structural, optical and transport data on GaN samples grown by hybrid, two-step low temperature pulsed laser deposition. The band gap of samples with good crystallinity has been deduced from optical spectra. Large below gap band tails were observed. In samples with the lowest crystalline quality the PL spectra are quite dependent on spot laser incidence. The most intense PL lines can be attributed to excitons bounded to stacking faults. When the crystalline quality of the samples is increased the ubiquitous yellow emission band can be detected following a quenching process described by a similar activation energy to that one found in MOCVD grown samples. The samples with the highest quality present, besides the yellow band, show a large near band edge emission which peaked at 3.47 eV and could be observed up to room temperature. The large width of the NBE is attributed to effect of a wide distribution of band tail states on the excitons. Photoconductivity data supports this interpretation. (C) 2002 Elsevier Science Ltd. All rights reserved.

STACKED N-I-P-N-I-P HETEROJUNCTIONS FOR IMAGE RECOGNITION

Vieira M, Fantoni A, Fernandes M, Louro P, Rodrigues I.

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Publicado em: *AMORPHOUS AND NANOCRYSTALLINE SILICON-BASED FILMS-2003* Editors: *Abelson JR, Ganguly G, Matsumura H, Robertson J, Schiff EA* MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS, 762199-204, 2003

This work aims to clarify possible improvements and physical limits of the Color Laser Scanned Photodiode image sensor when used as high sensitive non-pixel image reader. A new design based on a stacked n-i-p-n-i-p heterojunction is proposed and compared with the old single n-i-p sensing structure. Results show that a B-W image is acquired with an improved resolution. The readout frequency is optimized showing that scans speeds up to 10(4) lines per second can be achieved without degradation in the resolution. A physical model is presented and supported by an electrical and a numerical simulation of the output characteristics of the sensor.

BIAS CONTROLLED SPECTRAL SENSITIVITY IN A-SIC : H P-I-N DEVICES

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Publicado em: *THIN SOLID FILMS 427 (1-2): 196-200, MAR 3 2003,*

Large area p-i-n amorphous silicon-carbon heterojunctions with low conductivity and wide band gap doped layers were produced by plasma enhanced chemical vapor deposition at low temperature. Carrier transport and collection efficiency are investigated from dark and illuminated current-voltage dependence and spectral response measurements under different electrical and optical bias conditions. The results show that it is possible to control the absorption at a given wavelength and thus to tune the spectral sensitivity by changing the electrical bias around the open circuit voltage. A numerical simulation gives insight into the physical process and explains the bias controlled spectral sensitivity presented by the devices.

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Dugaev VK, Litvinov VI, Barnas J, Slobodskyy AH, Dobr ,

Publicado em: 16 (1): 67-70, FEB 2003 PASPS

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MODELING OF MAGNETICALLY CONTROLLED SI-BASED
OPTOELECTRONIC DEVICES

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OPTICAL PROPERTIES AND TRANSPORT IN PLD-GaN

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A GEOMETRIC APPROACH TO MOTION TRACKING IN MANIFOLDS

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Publicado em: *13th IFAC Symposium on System Identification, Rotterdam, The Netherlands, August 2003*

In many multi-dimensional tracking problems, the quantities of interest are restricted to a manifold in observation space. Learning the manifold shape is a necessary step for dimensionality reduction, which in turn allows faster and more robust tracking performance. For manifolds with arbitrary topology, learning the shape from noisy scattered data is not trivial. This paper presents a geometric approach that is valid for arbitrary manifold dimension and topology. An approximation of the tangent bundle is computed by region growing, making it possible to estimate a set of manifold charts. A tracking algorithm which takes advantage of the geometric information thus found is also presented.

INTERNAL ION MOLECULE REACTIONS INSIDE HETEROGENEOUS CLUSTERS TRIGGERED BY PHOTON IMPACT"

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Publicado em: *Book of Abstracts, XX International Symposium on Molecular Beams, Lisboa 8-13 Junho de 2003*

It is well known that molecular clusters are suitable systems to study elementary molecular reacting processes between a small and a controlled number of molecular species in presence.

In previous studies we have reported different mechanisms involved in internal clusters ion molecular reactions (ICIMR) triggered when molecular clusters are ionized by electron impact. In the present work we intend to continue and compare the study of these reactions replacing the electron impact ionization of the neutral clusters by a multiphoton ionization process.

Heterogeneous CO₂ and OCS clusters are obtained by isentropic expansions of these gases seeded in argon. The ICIMR reactions taking place inside these clusters after multiphoton ionization will be presented. This work is part of the project POCTI/33244/FIS/2000 of the Fundação para a Ciência e a Tecnologia, Portugal.

**FAST ACQUISITION AND TRACKING IN GNSS RECEIVERS
AN INNOVATIONS-BASED APPROACH**

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Publicado em: *Proceedings of the SPC2003 – ESA, Eight International Workshop on Signal Processing Techniques for Space Communications, pp. 412-419, Catania, Italy, September, 2003.*

Global navigation satellite system (GNSS) receivers perform a two-dimensional search to acquire code phase and Doppler shift information. In the conventional architectures, the Doppler frequency is estimated at different resolutions at different stages of the acquisition algorithm to pull-in track. Tracking is performed with two loops: one to track the code and the other one to track the carrier frequency. Instead the multi-stage frequency search, in this paper we propose a new open-loop technique using a bank of stochastic nonlinear filters (NLF). After coarse acquisition, the bank of NLF performs fine acquisition and tracking of phase and Doppler. Simulation results show the relevance of the adopted approach.

CLASS ADAPTED IMAGE COMPRESSION USING INDEPENDENT COMPONENT ANALYSIS

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Publicado em: *ICIP03-IEEE International Conference on Image Processing, vol. 1, pp. 625-629, Barcelona, Espanha, Setembro 2003*

This paper exploits *independent component analysis* (ICA) to obtain transform-based compression schemes adapted to specific image classes. This adaptation results from the data-dependent nature of the ICA bases, learnt from training images. Several coder architectures are evaluated and compared, according to both standard (SNR) and perceptual (*picture quality scale* – PQS) criteria, on two classes of images: faces and fingerprints. For fingerprint images, our coders perform close to the well-known special-purpose wavelet-based coder developed by the FBI. For face images, our ICA-based coders clearly outperform JPEG at the low bit-rates herein considered.

IMAGE COMPRESSION USING ORTHOGONALIZED INDEPENDENT COMPONENTS BASES

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Publicado em: *NNSP'03-IEEE Neural Networks for Signal Processing*, pp. 689-699, Toulouse, França, Setembro 2003.

In this paper we address the orthogonalization of *independent component analysis* (ICA) to obtain transform-based image coders. We consider several classes of training images, from which we extract the independent components, followed by orthogonalization, obtaining bases for image coding.

Experimental tests show the generalization ability of ICA of natural images, and the adaptation ability to specific classes.

The proposed fixed size block coders have lower transform complexity than JPEG. They outperform JPEG, on several classes of images, for a given range of compression ratios, according to both standard (SNR) and perceptual (picture quality scale - PQS) measures. For some image classes, the visual quality of the images obtained with our coders is similar to that obtained by JPEG2000, which is currently the state of the art still image coder. On fingerprint images, our fixed and variable size block coders perform competitively with the special-purpose wavelet-based coder developed by the FBI.

UNDERLYING ITS BUSINESS PROCESSES WITH FLEXIBLE AND PLUGGED PEER SYSTEMS: THE OPEN ITS-IBUS APPROACH

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Publicado em: *“Processes and Foundations for Virtual Organizations”*, Kluwer Academic Publishers, ISBN: 1-4020-7638-X, pages 221-230, em 2003

The extension of the Via-Verde business model from motorways and bridges to car parking and gas stations involving different enterprises has motivated the proposal of an open integration bus to answer the new challenges for systems integration. It is discussed a service framework based on a peer to peer distributed architecture where peers offer specialized services contributing to the execution of virtual business processes. Those specialized services are executed in a system container with “plug and play” features and some of them assume the responsibility for the execution and coordination of the business processes. The paper discusses the underlying strategy that has motivated BRISA, as ITS end-user, to promote an open strategy for the ITS-IBus integration framework. It is also discussed a strategy based on a distributed service framework offering an added flexibility to virtual business process execution and coordination.

FLEXIBLE AND PLUGGED PEER SYSTEMS INTEGRATION TO ITS-IBUS: THE CASE OF EFC AND LPR SYSTEMS

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Publicado em: *Processes and Foundations for Virtual Organizations*, Kluwer Academic Publishers, ISBN: 1-4020-7638-X, pages 231-240, em 2003

The development of new services to motorway users extending electronic fee collection (EFC) to car parking and gas stations requires an added flexibility from the underlying technological framework. The implementation of these facilities requires a new flexibility from the technological framework able to cope with the complex distributed cooperative processes crossing different companies. This paper describes the strategy adopted by the ITS-IBus project to promote a new organization for the toll underlying technologies, able to create the conditions to challenge new, flexible and innovative services. The adoption of a service based framework associated to the definition of a set of open interfaces based on existing standards is discussed.

An Open Integration Bus for EFC: the ITS-IBUS

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Publicado em: Actas da conferência ASECAP-2003, 18 - 21 de Maio de
2003 em Portoroz, Slovenia

The project BRISA ITS-IBus (Intelligent Transport Systems Integration Bus) aims at developing the architecture for a technological platform and business process modeling tools, able to establish a uniform integration framework to toll related system. A general purpose electronic fee collection process requires the support from different technological systems, in most cases integrated one by one on a bilateral agreement basis. The growing flexibility required from the toll infrastructures to support new business models and the need to reduce development and management costs are motivating an extra effort from different players to promote standards or, at least, opened and widely accepted consensus. The CEN initiative to normalize DSRC (Dedicated Short Range Communications) under TC-278 is an example of such an effort to promote interoperability and cost reduction by increasing reutilization.

EXTENDING BDI WITH EMOTIONAL DISPOSITIONS FOR ADAPTIVE SOCIAL REASONING

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Publicado em: *Proceedings of the 2nd International Workshop on Regulated Agent-Based Social Systems: Theories and Applications (RASTA'03).*

In dynamic and uncertain environments, where agents can have different behavior profiles, the ability to reason about the other agents in order to coordinate their activities raises many problems. In this paper we argue that adaptive motivational mechanisms are fundamental to address these problems, and that emotion can be a key element in the definition of those mechanisms. In this line of thought, we present an agent model of emotional disposition and show how it could be used to extend a classical BDI model for adaptive behavior, in a context of social interaction.

EMOTION IN INTELLIGENT VIRTUAL AGENTS: THE FLOW MODEL OF EMOTION

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Publicado em: *Rist, T. et al (Eds), Intelligent Virtual Agents, Proc. of IVA 2003, LNAI 2792, Springer-Verlag, 2003.*

Different models have been proposed to support emotion in artificial agents. However, a general framework to support the implementation of emotional agents of different kinds and levels of complexity is still not well defined. In this paper we present a model that is independent of specific physiological or psychological details, despite being inspired by biological processes, defining an emotional structure that can be objectively implemented and evaluated, and which can be used to integrate and extend other agent models, like deliberative models. Concrete results are presented to illustrate the model adequacy for agent emotional characterization.

OPTIMISATION OF CELL RADIUS IN UMTS-FDD NETWORKS

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Publicado em: in *Proc. of MWCS'03 12th IST Mobile & Wireless Communications Summit, Aveiro, Portugal, June 2003*

This work is focus on a key subject for Third Generation (3G) mobile operators, which is planning and optimising a UMTS-FDD multi-service mobile radio network. A planning and optimisation tool is presented, which optimises the cell radius as a function of a given scenario, users services characterisation, general radio network aspects, and quality indicators. Using this tool, impact and tendencies of several parameters over optimum cell radius are analysed, like urban characterisation parameters, population density, and general system configurations. Basically, linear and quadratic trends are obtained. For example, the population density impact on the cell radius, ranging from 2 500 to 20 000 persons/km² (only voice active), results in a cell radius from 700 to 400 m, respectively.

MULTI SERVICE CELL LOAD ESTIMATION ON UMTS-FDD

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Publicado em: in *Proc. of WPMC'03 - 6th International Symposium on Wireless Personal Multimedia Communications*, Yokosuka, Kanagawa, *Japão*, Outubro 2003.

This work is focused on a key subject for third generation mobile operators, which is planning the UMTS-FDD multi-service network. In order to achieve this goal, a UMTS system level simulator was built accounting for coverage and traffic, and implementing system load calculation algorithms. This simulator implements some of the most representative (“killer applications”) services, based on their respective source model at circuit or packet switch level, being mapped onto the FDD radio interface. The following traffic source models were implemented: Voice, e-mail and FTP, SMS, MMS, WWW, LBS and Streaming, and Video; most of the models are packet oriented, as the one presented by ETSI and the ON/OFF time and volume based model. Circuit and packet switch based services are distinguished as well by their real and non-real time dependence. The multiple services integration on a simulator allows a better and more accurate network performance analysis. A micro-cell propagation model, link budget, antenna pattern, channel codes and power constraints were also incorporated. Using this tool, the impact of several parameters over the cell load is analysed. For example running all services with a few users more than 20% of load is achieved.

TRACKING GROUPS OF PEDESTRIANS IN VIDEO SEQUENCES

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Publicado em: *2003 IEEE Workshop on Multi-object Tracking (WOMOT), Madison USA, June 2003.*

This paper describes an algorithm for tracking groups of objects in video sequences. The main difficulties addressed in this work concern total occlusions of the objects to be tracked as well as group merging and splitting. A two layer solution is proposed to overcome these difficulties. The first layer produces a set of spatio temporal strokes based on low level operations which manage to track the active regions most of the time. The second layer performs a consistent labeling of the detected segments using a statistical model based on Bayesian networks. The Bayesian network is recursively computed during the tracking operation and allows the update of the tracker results everytime new information is available. Experimental tests are included to show the performance of the algorithm in ambiguous situations.

I-Q MONOLITHIC OSCILLATOR DESIGN ON STANDARD CMOS TECHNOLOGY

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Publicado em: *ConfTele2003, 4th Conference on Telecommunications, Aveiro, Portugal*

This paper describes the design of an RC monolithic oscillator with quadrature outputs. Insight is given on a quadrature oscillator concept, followed by the adequate circuit topology for standard CMOS implementation. Presented simulations show the CMOS circuit ability to implement this kind of oscillators at high frequencies.

The layout is also presented, with proper design for 900MHz operation. It shows a compact design with a total area of 0.2mm².

CMOS MONOLITHIC WIDEBAND IMAGE REJECTION MIXER WITH POLYPHASE FILTERS

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Publicado em: *IMOC-International Microwave and Optoelectronics Conference, Vol.2 pp.815-818, 20-23 September 2003, Foz do Iguaçu, Brazil.*

Image rejection ratio in double balanced mixers is strongly dependent on the balance between its branches. The influence of mismatches is analysed and conclusions on the key aspects of the design to increase the image rejection are discussed. A practical circuit implementation is described: a 1.9GHz downconversion image rejection mixer is fabricated in 0.6µm CMOS standard technology. Measurements on the prototype showed a 34dB image rejection and an overall conversion gain of 16dB.

The growing needs for low power, low cost and highly integrated wireless mobile transceivers, have motivated researchers to present new monolithic solutions implemented in standard CMOS technology. One very important key-part of transceiver design that allows eliminating off-chip discrete components, for fully integration, is the mixer. The wide-band intermediate frequency (IF) architecture converts all radio frequency (RF) spectrum, passing through the input RF filter, directly to base band (BB) as in the case of direct conversion receivers. No band pass filtering is performed at IF. However, differently to direct conversion, the translation takes place in two steps, using two local oscillators (LO) and two sets of mixers. This provides the following main advantages: no oscillator operates at RF input frequency; tuning the receiver can be accomplished with the second LO at a lower frequency.

The double balanced mixer presented is an image rejection (IR) converter that uses six balanced mixers to implement the above referred architecture. Each balanced mixer can be easily implemented with CMOS Gilbert cells. If the branches are perfectly matched and the local oscillators are applied in quadrature the image ($IM-f_{IM}=2f_{LO}-f_{RF}$) is fully rejected.

A 1.9GHz CMOS MONOLITHIC UP-CONVERSION MIXER

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Publicado em: *ConfTele2003 - IVth Tele-communications Conference, Vol.1*
pp.83-86, 18-20 June 2003, Aveiro, Portugal.

Wireless communications technology has been one of the fastest growing technologies during the last years. The new opportunities created with this advent allows the development of more innovative, low-cost, low power and robust solutions emphasizing higher integration and less weight.

Actually CMOS is the best solution process for low cost and high integration. The development of high performance RF front-ends requires innovative RF circuit designs to make the best of a good technology and reduce the off-chip discrete components. To reduce the off-chip components the mixer is a very important key-part in transceiver design. Mixers are found in all wireless communications systems and, as the level integration is increased and passive off-chip elements in RFIC are eliminated, conversion gain and port-to-port isolation will be required to compensate the lower LO and the reduced performance filtering on-chip.

This paper describes the design and simulation of a 1.9GHz monolithic Up-Converter mixer implemented in a standard 0,6 μ m CMOS technology. The simulations were performed with BSIM3 model. The mixer presents 15dB conversion gain at 1.9GHz for 3.3V power supply with a LO drive of 1dBm while consuming 2mA. The third-order input intercept point is +6dBm and the input 1dB compression point is -4dBm. The mixer employs an all n-channel devices and resistive loads for high frequency operation and requires no inductors on or off-chip. As all the devices are fabricated on a single chip, the balance is very good and high spurious rejection is obtained.

CAPACITY OF MIMO SYSTEMS BASED ON COST 259 DCM SIMULATIONS

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Publicado em: *Proceedings of 4th Conference on Telecommunications, Aveiro, Portugal, Junho de 2003, pp. 9-12.*

Capacity of MIMO (multiple-input/multiple-output) Systems based on COST 259 channel model simulations are presented in this paper, for two different radio environments, micro- and picocell.

Two different power allocation strategies are considered, “water filling” and uniform and two different antenna topologies, 4x4 and 2x4.

It is shown that space diversity used at the MIMO radio link is an efficient technique mainly in the picocell scenario, achieving capacities of 17 bit/s/Hz for 50% outage level using a 4x4 antenna configuration implementing water-filling at a SNR of 20 dB.

CAPACITY OF MIMO SYSTEMS IN 3G MICRO- AND PICOCELLS BASED ON DIRECTIONAL CHANNEL MODEL SIMULATIONS

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Publicado em: *Proceedings of Progress in Electromagnetics Research Symposium 2003, Honolulu, USA, Outubro de 2003, pp.171.*

The capacity increase available from deploying multiple antennas at both the MS and the BS, has generated considerable interest in recent years. The capacity variations on the multiple-input/multiple-output (MIMO) radio channel will be simulated using the COST 259 Directional Channel Model as a tool to predict the radio environment. This will be done for two different 3GPP scenarios, exploiting the micro- and picocell case.

COST 259 DCM was implemented in MATLAB, for the two cell types (microcell and picocell). The model was developed using a modular structure, based on a certain number of properties implemented in the following order: cluster generation, cluster time and angular dispersion calculations, path-loss calculation using cell type dependent path-loss models, large-scale and small-scale fading implementation and finally the multi-path components (MPCs) definition (delay, angle, power amplitude and phase). This allows the user to obtain the directional channel impulse response (DCIR).

The 3GPP recommendations in were followed and were implemented two environments, micro- and picocell.

The MIMO capacity dependence on the SNR when the water filling power allocation scheme is used was also tested. Two antenna setups, a 4x4 and a 2x4 were compared.

Some conclusions can be drawn: the capacity increases with SNR and with the channel decorrelation. As the channel decorrelation increases, the 4x4 antenna configuration takes full advantage of its additional sub-channel compared with the 2x4, i.e., in the picocell scenario the capacity increase with SNR is larger than in the microcell scenario.

In this paper a stochastic MIMO radio channel model has been introduced using the multi-environment COST 259 directional channel model. The advantage of the proposed model is that it relies on a well structured and measurement tuned channel model, which reflects and predicts in a realistic way the main propagation behavior for different scenarios. As such, it can be used for link-level simulation studies.

CAPACITY OF MIMO SYSTEMS BASED IN 3G MICRO- AND PICOCELLS

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Publicado em: *Proceedings of 6th International Symposium of Wireless Personal Multimedia Communications 2003, Yokosuka, Japão, Outubro de 2003, V2 pp 430-434.*

Capacity of MIMO (multiple-input/multiple-output) systems based on COST 259 channel model simulations are presented in this paper, for two different radio environments, micro- and picocell. Two different power allocation strategies are considered, “water filling” and uniform with different antenna topologies, 2x4, 3x4 and 4x4.

It is shown that MIMO usage is an efficient technique mainly in the picocell scenario, achieving capacities of 17 bit/s/Hz for 50% outage levels. In this case a 4x4 antenna configuration was used implementing water-filling at a SNR of 20 dB.

Considering MIMO application to UMTS system, half of the wavelength spacing between elements maximizes capacity considering SNR and MS size limitations. The number of antenna elements at the MS will depend on the mobile equipment characteristics.

TESES

APLICAÇÃO DA ANÁLISE EM COMPONENTES INDEPENDENTES NA COMPRESSÃO DE IMAGEM

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Orientadores: Mário Alexandre Teles de Figueiredo

Provas Concluídas em: 10 de Março de 2003

Neste trabalho utiliza-se a análise em componentes independentes na codificação, com perdas, de imagem. As componentes independentes constituem os vectores de base para a representação da imagem. Tratam-se aspectos de desenho e implementação de codificadores baseados em transformadas ortogonais e não ortogonais. Consideram-se os modos de operação sequencial, progressivo e multi-resolução, analisando a imagem com blocos de dimensão fixa e variável. Na codificação entrópica, com modelo de fonte, utilizam-se técnicas semi-adaptativas e adaptativas.

Estudam-se as capacidades de generalização e adaptação das transformadas, ortogonais e não ortogonais, sobre classes de imagens. Avaliam-se os resultados dos pontos de vista da taxa de compressão, da distorção objectiva (relação sinal/ruído), da distorção visual e do peso computacional.

Verifica-se que a base de componentes independentes possui capacidade de adaptação a classes específicas de imagens. Identificam-se classes para as quais a capacidade de generalização é semelhante à de transformadas independentes dos dados. Caracterizam-se cenários de utilização onde, à mesma taxa de compressão e com peso computacional idêntico, os codificadores propostos apresentam menor distorção objectiva e visual do que o codificador JPEG.

Palavras Chave: Análise em componentes independentes, Codificação com perdas, Codificação de imagem, Pesquisa de projecções, Classes de imagens, Avaliação da qualidade perceptual de imagem.

TECHNO-ECONOMIC ANALYSIS AND METHODOLOGICAL FRAMEWORK
FOR BROADBAND PROVISION IN RURAL AND PERIPHERAL AREAS :
APPLICATION TO THE PORTUGUESE LANDSCAPE

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Provas Concluídas em: *17-09-2003*

This dissertation addresses the problem of ensuring that citizens and organisations have physical access to the instruments and services of an Information Society, and is specifically targeted to the identification of the technologies and network solutions with highest potential for the provision of universal access to communication services in rural and peripheral areas.

This project aims to develop a methodological framework for the techno-economic evaluation of telecommunication services provision as a function of the rural region topology, demography, geography and socio-economic characteristics. Thus its motivation is to provide a contribute to answer the following question:

How to provide broadband in rural and peripheral areas?

This problematic can be subdivided in six fundamental questions:

1. What are the possible technical solutions? (Combinations of copper, fibre and radio media, convergence of wired and wireless systems, etc.)
2. What are the possible deployment strategies? How do they compare in terms of first installed costs and operational costs?

MIMO SYSTEMS FOR 3G MOBILE CAPACITY ENHANCEMENT

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Provas Concluídas em: *19 de Dezembro de 2003*

O objectivo desta tese consiste em estudar a melhoria de capacidade associada à introdução da tecnologia MIMO no sistema UMTS.

Numa primeira fase, foi efectuada a caracterização do canal rádio para um ambiente de propagação específico de macro-, micro- e pico-célula, utilizando o modelo direccionado de canal associado ao COST 259.

Seguidamente, é efectuada a modelização do canal MIMO utilizando a plataforma COST 259 anteriormente desenvolvida. A análise dos valores próprios é apresentada como uma técnica associada ao conceito de transmissão em canais ortogonais, e ainda a adaptação da fórmula de Shannon ao sistema MIMO. São simuladas duas estratégias de distribuição de potência (uniforme e water-filling) utilizando várias configurações MIMO para diferentes valores de relação sinal-ruído.

Finalmente é abordada a problemática de aplicação da tecnologia MIMO ao UMTS HSDPA, assumindo um cenário multi-utilizador. A capacidade de Shannon é utilizada como uma métrica a ser transmitida na ligação ascendente, e desempenha um papel fundamental na determinação do ritmo de transmissão, estimação da taxa de tramas perdidas e escalonamento, ao nível do Node B. Foram introduzidas duas técnicas de escalonamento, denominadas Fair Capacity e Maximum Capacity SBSA, que utilizam a transmissão da métrica de Shannon para a melhoria de desempenho do sistema.

Palavras-Chave: Comunicações Móveis, UMTS, Modelo Direccionado de Canal, Sistema MIMO, HSDPA, Eficiência Espectral.

