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Appendix

Abstracts & Titles, No. 163~167

BULLETIN

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HOKKAIDO UNIVERSITY

No. 163

March 1993

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Study on Static and Buckling Systematic Analyses of Partial Composite Circular Plates

Koichi SATO

(Received October 29, 1992)

Abstract

This paper offers one of the practical methods designed to enable static and buckling systematic analyses of partial (incomplete) composite circular plates consisting of two layers of isotropic materials. The paper also analyzes the relationship of lateral deflections and critical loads among complete composite circular plates, partial composite circular plates and individual circular plates that do not interact with regard to simply supported circular plates subjected to rotationally symmetric distributed load. The paper also submits non-dimensional parameters that represent the essential features of the lateral deflection and critical load characteristics of simply supported partial composite circular plates suitable for most design purposes. $\alpha = 1$ signifies complete composite circular plates. $0 < \alpha < 1$ signifies partial composite circular plates. $\alpha = 0$ signifies individual circular plates that do not interact. Lateral deflections and critical loads can be derived by the use of non-dimensional parameters without too much difficulty.

Supersonic Position Measurement and its Applications to Human Interface

Hidetoshi NONAKA and Tsutomu DA-TE

(Received October 28, 1992)

Abstract

This paper presents new position measuring method and its applications to human interface. It is based on the principle of supersonic position measurement by phase difference. Any kinds of motor actions of users is available to screen pointing by the device, then it allows computer users various pointing styles including"mouse-like" one.

Firstly, the principle and the formulae of supersonic position measurement are introduced. Secondly, trial construction of the pointing system is described, and performance of the pointing system is investigated using test system constructed with X−Y plotter. Finally some examples of pointing devices with various pointing styles are realized, and experiments on the efficiency of pointing tasks with computer users are carried out to conclude that the pointing system is suitable for practical use.

Approximate Solution of Fuzzy Arithmetic Equations using Digital Representation

Mayuka F. KAWAGUCHI, Tsutomu DA-TE

(Received October 30, 1992)

ABSTRACT

This paper deals with the equations with fuzzy arithmetic operations based on sup-min convolution. Fuzzy arithmetic is expected to make possible to apply fuzzy theory to various kinds of mathematical techniques in the engineering fields. Since Sanchez formalized this type of equations and their solution, several researchers have investigated their properties, especially their solvability. However practical calculation methods for their solutions have not been studied so far.

The authors apply the digital representation method, which has been proposed in our previous paper, to the procedure to solve fuzzy arithmetic equations (i.e. inf-α convolution). We derive the formulae for three kinds of parameters which are necessary for our calculation method. Moreover, the necessary and sufficient condition for the solvability of fuzzy arithmetic equations is summarized. Some numerical examples shows that our method is effective for solution of the equations.

Nonlinear Time Series Analysis

—5. An Analysis of Time-Series Data in Medical and Biological Branches by The Use of "MemCalc"—

Norio OHTOMO*), Nobuaki TAKAHASHI**), Akio KOYAMA***)
Hirokatu IWASA*), Saburou TERACHI+) and Yukio TANAKA++)

(Received October 1. 1992)

Abstract

Time-series data in medical and biological branches, such as temporal variations of human body temperatures, pulse waves of the blood pressure, heart rate, amount of rat's spontaneous activity and brain waves, are analyzed by the use of MemCalc system, which is a newly-devised realization of nonlinear analysis (see paper 2 in the present series). PSD's (power spectral densities), autocorrelation functions and the best fitting curves for these time-series data are calculated by MemCalc. The PSD spectra of these indicate a power law of $1/f$ (f : frequency) at low frequencies, which is considered to reflect the intermittent chaos phenomena. The effects of the log-transformation and the moving-average are discussed.

Nonlinear Time Series Analysis

—— 6. On the MEM Spectrum for Cyclic Functions ——

Yukio TANAKA,*) Norio OHTOMO**) and Saburou TERACHI***)

(Received October 1, 1992)

Abstract

MEM power spectral density (MEM-PSD) was calculated for two artificial data by the use of MemCalc system which is a computer program developed by one of the authors (Y. Tanaka). The first data (case I) is made up of three cosine functions with frequencies of 2 Hz, 5 Hz and 10 Hz, respectively, and the other (case II) of nine cosine functions with frequencies of 2 Hz, 3 Hz, 4 Hz, ···, 10 Hz, respectively. Each data has no erratic component.

The obtained MEM-PSD was composed of three peaks (case I) or nine peaks (case II) regarded as δ functions. Each peak frequency accurately corresponds to the frequency of the cosine function within ± 0.007 Hz. Around each peak, the MEM−PSD was integrated. The integrated values are between 0.496 and 0.510, which are in excellent agreement with the theoretical value 0.50 for one-sided spectrum of a cosine function.

No. 164

May 1993

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Study on Composite Degree Expression and Its Application to Analyses of Composite Plates

Koichi SATO, Akio OIKAWA, Takashi OBATA and Hideyuki HIRASAWA
(Received December 30, 1992)

Abstract

This paper offers a set of practical expressions on the composite degree designed to enable static and buckling analyses of partial (incomplete) composite plates consisting of two layers of isotropic materials.

The paper also analyzes the relationship of lateral deflections and critical loads among complete composite plates, partial composite plates and individual plates that do not interact with regard to simply supported rectangular composite plates subjected to fully distributed loads and simply supported circular plates subjected to rotationally symmetric loading.

$\alpha=1$ signifies complete composite plates.

$0<\alpha<1$ signifies partial composite plates.

$\alpha=0$ signifies individual plates that do not interact.

Influence of Molecular Structure of Aromatic Fuels on Diesel Combustion and Emissions

Masahiko SHIBUYA, Noboru MIYAMOTO, Hideyuki OGAWA, Keiji ARAI and Oliver ESMILAIRE
(Received December 22, 1992)

Abstract

The influence of mono-aromatic and di-aromatic compounds in fules on particulates, SOF and NOx emissions from a diesel engine were analyzed. Mixtures of normal -paraffin, iso-paraffin, alkyl-benzene and 1-methylnaphthalene were used as the testing fuels. The aromatic content varied from 0% to 60% for the mono-aromatic fuel and 0% to 40% for the di-aromatic fuels. Experimental results showed that, at the same equivalence ratio and regardless of the aromatic ring number of the fuel, particulate emission increased linearly with respect to the C/H ratio. The degree of increase in particulate emission with increasing C/H ratio decreased with lower equivalence ratios. The NOx emissions increased with increases in fuel calorific value per unit volume. The aromatic content, aromatic type, and equivalence ratio seem to have a small effect on the SOF emission level.

Fractography of Translaminar Fractures of Carbon Fiber Reinforced Plastics

Toru NOGUCHI*, Ken NARUSE**,
and Eiki TSUSHIMA***
(Received December 21, 1992)

Abstract

The fracture morphology of continuous fiber reinforced composites is very complicated and it is difficult to estimate the fracture process by fractography. In this report, translaminar type fracture of continuous carbon fiber composite was investigated, and it was attempted to determine indicators of fracture path, fracture origines, and loading conditions by SEM fractography. Three types of model specimens and two types of bulk specimens were fractured by static and impact bending. Fractured surface was examined by SEM, and microscopic fracture appearance was related to macroscopic fracture features.

In high magnification observations, the local crack direction can be determined by mapping of the radial mark direction on broken fiber ends, tension-compression boundary lines in buckled fibers and other microscopic morphologic features. For failure analysis, however, low magnification observation is more effective; the overall fracture direction and fracture initiation region can be estimated from macroscopic ridge marks, micro-buckling bands, and intralaminar shear cracks, and these estimates are confirmed by higher magnification observations.

Measurement of Surface Recombination Velocity of Si Surface by Photoluminescence Method

Yoichiro NISHIMOTO, Toshiya SAITOH and Hideki HASEGAWA
(Received December 24, 1992)

Abstract

The surface recombination velocity, S, is an extremely important parameter for minority-carrier devices, including solar cells. Particularly, in high efficiency solar cells based on high-quality single crystals, the energy conversion efficency, η, becomes strongly dependent on S. However, no well-established method exists at present to measure the value of S correctly under a sun light illumination.

This paper presents a new measurement method of S based on photoluminescence. It is contactless and non-destructive, and determines the value of S under illumnation. The new method was successfully applied to various passivated Si wafers.

Genetic Algorithm for Concepts Learning.

Satoshi ENDOH, Shingo NOZAWA and Azuma OHUCHI
(Received December 25, 1992)

Abstract

Numerous research word concerning the induction are performed in the field of the artificial intelligence.

The Version space algorithm developed by Mitchell is known well as a typical method for learning single concepts.

The single concept learning problem is an essentially combinatorial optimization problem of the attribute value.

Genetic algorithms are paid close attention as an effective method of the combinatorial optimization problem in recent years.

In this paper, we proposed a genetic algorithm as a learning mechanism of the single concept learning.

Further, we described the expansion of this algorithm and discussed the effectiveness.

A Speckle Reduction Filter Using Contrast Information

Tomoyuki MITAMURA, Hideo KITAJIMA, Tomoaki SHIRAKAWA, and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper proposes an effective reduction of speckle noise in reconstructed synthetic aperture radar images.

The proposed method uses contrast information in the reconstruction and avoids serious blurring typically accompanying images obtained through the conventional multi-look operation.

Computer simulation resulting in demonstrating the validity of the method are included.

Roadmap Data Compression through Extraction of Characteristic Points and Linear Approximation

Tatsuya AOYAMA, Hideo KITAJIMA, Tomoaki SHIRAKAWA, and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper proposes an effective compression of roadmap data the volume of which is formidable if it is in an uncompressed, raw form.

The proposed method extracts features such as crossings, end points, and curves from a roadmap.

They are subsequently decomposed into position data and connectivity data which are compressed separately.

Simulation results are included to demonstrate that 1/70 compression is possible with this method.

DCT Coding of Images with Improved Edge Reconstruction

Tomohiro IWANAGA, Hideo KITAJIMA, Tomoaki SHIRAKAWA, and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper proposes new distcrete cosine transform coding of images with edge information retained more faithfully.

Edges are often blurred in conventional transform coding.

The proposed method uses a differential filter, the outputs of which are used to determine quantization schemes.

Adaptive Predictive Image Coding Using Variable Block Shapes Controlled by Edge Orientation

Kenji EBITANI, Hideo KITAJIMA, Tomoaki SHIRAKAWA and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper proposes an efficient image coding scheme targetted for low bit rate applications.

In the core of the proposed method are predictors adaptively switched in accordance with local edge contentents and blocks stretching in the direction of edges.

The method is characterized by improved edge reconstruction and unsaturated SNR'S in the 1.5~3.0 bits/pel range which were not possible in similar previous methods.

Variable-Block-Size Motion Compensation DCT Coding Method Using Subband Hierarchical Image

Noriyuki HAYASHI, Hideo KITAJIMA, Tomoaki SHIRAKAWA, and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper proposes a new motion picture coding scheme based on variable-block-size motion compensation for interframe prediction.

The motion compensation uses subband hierarchical images for generating variable block sizes, the use of which makes possible downsizing the block size until it matches local pictorial contents and enables accurate motion detection.

Adaptive DCT coding of the prediction errors follows the motion-compensated prediction process.

Simulation results indicate that the proposed method yields better image quality than conventional methods.

Extraction of Characters and Symbols from City Maps

Takaya WATANABE, Hideo KITAJIMA, Tomoaki SHIRAKAWA and Yoshihiko OGAWA
(Received December 25, 1992)

Abstract

This paper introduces a new algorithm for extraction of characters and symbols from other graphical primitives in city maps.

Their extraction is an essential step in automatic processing of a city map drawn on paper.

The algorithm is intended to solve problems arising from characters/symbols being in contact with other primitives.

It is based on masking operations followed by other separation steps.

Results of computer experiments are included to show the effectiveness of the algorithm.

Stress Analysis by FEM of a Central Opening Bileaflet Prosthetic Heart Valve

Yukiaki KIKUTA, Hiroshi KASAI, Keisuke OKUNO and Toshio YUHTA

(Received December 25, 1992)

Abstract

In this paper we described a stress analysis of our new mechanical valve. Using finite element method (FEM), an aluminum alloy (JIS A 7075-T 6) leaflet and a stainless steel (JIS SUS 430 F) leaflet stopper are estimated by the von Mises stress contours and the deformations at the static analysis.

Three dimensional solid elements are utilized to obtain simulated leaflet models, which have 0%, 9%, 11%, 13% curvatures, and a simulated leaflet stopper model. For parametric studies, leaflet constraint conditions and leaflet curvatures are used on the supposition of the closed valve.

An optimum leaflet support (using 9% curvature leaflet model) and an optimum leaflet curvature (having constraint around axis) are evaluated and the stress analysis of leaflet stopper are studied.

From the results of the leaflet stress analysis, it is shown the lowest stress on the leaflet to constraint of all leaflet edges or have 9% and 11% leaflet curvature. From the result of the leaflet stopper analysis, there is no significant stress problem at the static stress analysis.

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Microspherical Agglomeration of Ceramic Powder in Organic Liquid With Extremely Small Quantities of Bridging Liquid

Winston GUINTO, Tsuyoshi HIRAJIMA and Masami TSUNEKAWA

(Received March 4 ,1993)

Abstract

The possibility of using the method of spherical agglomeration in liquid with extremely small quantities of bridging liquid for the production of ceramic microspheres was investigated. The experiments were conducted using a suspension of zirconia powder in normal hexane agitated by a rotary shaker. No bridging liquid was added, instead, agglomeration was based only on the moisture content of the zirconia powder. The results indicate that by using this method it was possible to produce microagglomerates with diameters less than 500 μm and nearly theoretical density. In addition, the agglomerate size, size distribution, sphericity and density of sintered microagglomerates were greatly affected by the solids concentration, agitation intensity, agglomeration time and volume of suspending media. It is necessary to optimize these process parameters in order to produce agglomerates with desirable properties.

A Study on Transient Thermal Stress in Cylinder Liners in Diesel Engines

Toshio SUZUKI*), Takemi CHIKAHISA**) and Tadashi MURAYAMA**)

(Received March 31, 1993)

Abstract

The paper investigates transient thermal stress and an effective cooling method in a cylinder to solve cylinder liner damages. One-dimensional unsteady heat conduction analysis was performed to analyze the transient thermal stress and temperature profiles.

The result shows that the temperature fluctuation is very small except for the inner wall surface and that the maximum stress occurs in a steady state operation rather than in transient operation at starting up. Thus the steady state analysis of thermal stress is sufficient for the analysis of liner damage. A steady state heat transfer analysis showed that installing cooling pipes in a cylinder is effective to reduce the inner wall temperature, but it gives a large stress concentration on the pipe. The paper investigates optimum location of the pipes.

An Analysis of the Optimum Turbulence Condition in D.I. Diesel Engines with Turbulent-Cell

Mitsuru KONNO, Takemi CHIKAHISA and Tadashi MURAYAMA

(Received March 31, 1993)

Abstract

A thermodynamic analysis was made to evaluate the effects of design parameters, such as the cell volume ratio, sub-fuel ratio, diameter of passageway leading to the main chamber, sub-fuel injection timing, etc, on the momentum of the gas jet from the turbulent-cell.

The results showed that the momentum of the gas jet increases with increasing cell volume, and the momentum comparable to that found in precombustion chamber diesel engines can be created when the cell volume is approximately 10 percent of the clearance volume. However, it was shown that the heat loss increases with cell volume, therefore, it is necessary to limit the cell volume to an appropriate size such that sufficient turbulence is generated in order to reduce diesel particulate matter. It was also shown that the optimum amount of sub-fuel is stoichiometric to the amount of air in the cell, and that restricted passageway results in high turbulence.

On the Factors of Generating Incomplete Fusion and Incomplete Penetration Defects in MAG Welding

Takayoshi UKAI, Toshiaki TAKADA and Kouichi ISHIKAWA

(Received March 31, 1993)

Abstract

This study is concerned with the factors of generating incomplete fusion and incomplete penetration defects in the popular MAG welding. The experiments were performed under the intensionally different conditions from the optimum conditions in the welding. The experimental assesments were carried under macroscopic test and the JIS bending test.

The summaries of this study are as follows:

(1) All the factors of generating incomplete fusion and incomplete penetration defects in welding became clear.

(2) The mechanisms of generating those defects became clear.

(3) As being applied the interpretive structural method, the directed graph which showed the relations of these each factors was proposed. This graphic expression is very useful to the education and training for welding operator.

Study on a Magnetic Dynamic Vibration Absorber with Adjustable Natural Frequency

Satoru IGARASI*, Katsuhisa SHIBUKAWA* and Hiromi SEKITO**

(Received March 31, 1993)

Abstract

In a previous paper, we proposed a new magnetic dynamic vibration absorber which has a function of tuning the natural frequency to the exciting frequency automatically by adjusting the distance between magnets used as a repelling force system.

In this paper, we analyze a system equipped with the proposed vibration absorber taking into account nonlinear properties of restoring force and to investigate the response of the system through vibration experiments.

Based on these results, we propose an adaptive method for adjusting the distance between magnets such that the amplitude of the primary system is reduced as small as possible.

Vibration experiments assure that the amplitude of the primary system can be suppressed in sufficiently small values by applying the proposed method.

Evaluation of Effect on Configurations by Perturbation of The Data Points.

Hideyuki IMAI, Jun-ichi SATO and Tsutomu DA-TE

(Received March 30, 1993)

abstract

Projection pursuit (PP) is one of the multivariate methods to find the most 'interesting' low-dimensional projections of a high dimensional data set. PP defines the measure of interestingness as nonnormality of projected distribution.

In PP algorithm, nonnormality is translated into the computable expression called "projection index". So the projection index must have a large value when the projected distribution is nonnormal and small value otherwise. PP procedure searches projective plane by numerically maximizing the projection index. Some projection indexes are suggested by Friedman, Hall, and so on.

The Multivariate data may include outliers, and they give bad effect on the result of analysis. In this paper, we try to evaluate how the configuration is affected by perturbation of the data points to find such data.

Learning Task Attainment Path Analysis by FISM.

Kohki ITOH and Azuma OHUCHI

(Received March 30, 1993)

Abstract

One of the effective methods for evaluating how well students understand materials is to identify the students' point of view of logical relations among materials and to compare it with the teachers' point of view. A comparison is made for finding those discrepances between both views that are to be dissolved in the succeeding teaching process. With previous methods, however, it is difficult to analyze how to dissolve part of the discrepance effects from other parts.

In this paper we propose Learning Task Attainment Path analysis (LTAP analysis) as an application of FISM (Flexible Interpretive Structural Modeling). In addition to previous points of view such as correct response rate and attainment order, LTAP analysis has some new points of view such as discrepance degree, etc. We have applied LTAP analysis to the evaluation of classes in programming language LISP. The result shows that LTAP is effective for measuring how well students understand learning tasks.

A procedure for solving satisfiability problem based on the partial instantiation technique in the first-order logic.

Masahito YAMAMOTO, Toshio OHYANAGI and Azuma OHUCHI.

(Received March 30, 1993)

Abstract

Satisfiability problem in the first-order logic is one of very important problems in the field of information science. Many methods for solving these problems have been proposed. In 1988, Jeroslow proposed a procedure for deciding whether given formulas without function symbols are satisfiable or not. This method is remarkable for using the partial instantiation technique. However, it has some following weakpoints:

(a) it is not suitable for checking satisfiability of formulas given in clausal form, (b) an increase of formulas reduces computational efficiency. Moreover, no reports concerning implementations of Jeroslow's method have been done so for.

This paper intends to present a procedure for solving satisfiability problem based on the partial instantiation technique. The proposed procedure restricts given formulas to be in clausal form to improve Jeroslow's method. Some computational results are also reported.

Disjunctive Concept Aquisition using Genetic Algorithm

Shingo NOZAWA Satoshi ENDOH and Azuma OHUCHI

(Received March 30, 1993)

Abstract

As shown in Mitchell's paper, concept aquisition may be viewed as a search problem in a hypothesis space defined by the representation language. Its goal is to find the concept description that satisfies the completeness and consistency. Most of concept aquisition methods assume that concepts are independently separable and be must aquired as a single conjunctive description. However, real life concepts do not always hold this assumption and often need disjunctive concept description. This paper presents a new method for aquiring disjunctive concept description. We use genetic algorithm to search in a hypothesis space. This method has been implemented in the concept aquisition system COAST/GA, and a detailed example of its execution is presented.

Introduction of Elementary Quantum Mechanics Using a Symbolic Manipulation Program

Yutaka ABE

(Received March 31, 1993)

Abstract

This article discusses a set of symbolic manipulation programs developed to reinforce understanding of basic concepts presented in a introductory quantum mechanics course.

It was designed that the solutions of the problems were analytically tractable as well as numerically obtainable.

We have shown that several examples which are very effective for the constructive reinforce to grasp the basic ideas rather than a complex junk of numerical computational examples.

We derive some guiding principles for the introduction of computational method into the undergraduate course of quantum mechanics.

An Exact Numerical method for calculating Fermi Energies and Carrier Concentrations in Semiconductors (II)

Yutaka ABE

(Received March 31, 1993)

Abstract

In this report, we discuss the detailed numerical method for calculating the the Fermi energies and carrier concentrations in various seniconductors. Especially, we treat the following topics; i) the temperature dependence of electron concentrations in heavily compensated n-type Si, ii) effect of variation in ionization energy of shallow impurities on the carrier concentrations and iii) the effect of band nonparabolicity on the density-of-state in narrow-gap semiconductores.

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October 1993

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Strength of Sand as Observed in a newly Developed Direct Shear Box Apparatus

Satoru SHIBUYA[1], Toshiyuki MITACHI[2], Akira KITAJIMA[3] and Masuo TAKADA[4]

(Received October 30, 1992)

Abstract

A direct shear box apparatus (DSBA) has been developed for examining the strength and dilatancy of sand. In this apparatus, the boundary stresses on the bottom and side of the shear box as well as strains of the rectangular-shaped specimen inside the rigid box can be observed throughout testing. This paper first describes features and functions of the DSBA. Second, the results of some pilot tests performed on dry specimens of two kinds of clean sands are presented by which the effects of some factors such as friction between the side wall and the specimen, the size of opening between the upper and lower shear boxes, the specimen height etc. are examined with respect to the peak strength. It is demonstrated that the peak strength of the sands as sheared under a constant vertical stress apparently increased as the size of opening between the rigid boxes, maintained at a constant value in each test, decreased towards zero. The size of opening being equal to, or slightly larger than the width of shear band, which is approximately twenty times the mean diameter of the particles, is recommended to measure the strength free from the boundary constraints. In conclusion, an optimal configuration of the DSBA is proposed so as to yield the strength associated with simple shear conditions.

Experimental and Numerical Study on Melting Heat Transfer of Liquid Ice in a Rectangular Cavity

Shoichiro FUKUSAKO, Masahiko YAMADA, and Myoung-hwan KIM

(Received June 28, 1993)

Abstract

The melting characteristics of liquid ice in a rectangular cavity was studied experimentally and numerically. The liquid ice, mixture of ice particles and ethylene-glycol aqueous solution, was heated from one of the vertical walls of the cavity. The shape of the mush -liquid interface, melting rate, and local/mean heat-transfer coefficient at the heated vertical wall were observed, measured, and calculated under a variety of conditions of heat flux and initial concentration of aqueous binary solution. It was found that the formation of double -diffusive layers based on the thermal and solutal buoyancy forces exerted a great influence on the melting process of the liquid ice.

Melting heat transfer from a ice cylinder immersed in saline water

Shoichiro FUKUSAKO, Masahiko YAMADA, and Chikara WATANABE

(Received June 28, 1993)

Abstract

Experiments were performed to determine the effect of saline water concentration on the melting heat-transfer characteristics of a horizontal ice cylinder immersed in quiescent saline water. The ambient saline water concentration ranged from 0.5 to 3.5 wt% in salinity for ambient temperature ranging from 1.8 to 24.0 °C. The measurements show that the flow patterns around the ice cylinder are a strong function of the saline water concentration, which causes a considerable effect on the local heat-transfer coefficients along the ice cylinder.

Completion with Multiple Reduction Orderings based on ATMS Data Structure

Hisashi KONDO, Masahito KURIHARA and Azuma OHUCHI

(Received June 24, 1993)

Abstract

The Knuth-Bendix completion procedure either succeeds, fails or diverges indefinitely. Success of the procedure heavily depends on the choice of a reduction ordering for orienting equations.

In this paper, we propose a completion procedure which are run with multiple reduction orderings. Actually, the procedure simulates the concurrent computation in which the ordinary completion procedures are run in parallel for each ordering. To gain efficiency as much as possible, we use the idea of ATMS(Assumption-based TMS). As a result, most of the results inferred in a concurrent process for one ordering can be reused in processes for other orderings.

MODEL FOR DEPOSITION OF THIN FILMS IN PLASMA CVD

Tomoaki HINO, Ichiro FUJITA and Toshiro YAMASHINA
Noriaki UEDA[1], Naoto ASAMI[1] and Masana NISHIKAWA[1]

(Received June 28, 1993)

Abstract

A simplified model is proposed to describe the deposition process of thin films in plasma CVD techniques. The film deposition rate is explained by the terms of fluxes of reactive species and fluxes of particles etched from the substrate and diffused into bulk substrate. Several examples of the film deposition are discussed, based upon the present particle balance equation. The particle balance in the ion beam implantation technique is also briefly discussed.

Heat Load Experiments for Bulk Boronized Graphite

Ichiro FUJITA, Tomoaki HINO, Toshiro YAMASHINA,
Yusuke KUBOTA[1], Nobuaki NODA[1], Akio SAGARA[1], Noriyuki INOUE[1], Osamu MOTOJIMA[1]
Teruo MATSUDA[2], Toshiaki SOGABE[2] and Koji KURODA[2]

(Received June 28, 1993)

Abstract

Bulk boronized graphite with different boron contents, GB-100, GB-103, GB-110 and GB -120, were exposed to the high heat flux up to 6MW/m^2 for 120 seconds, in the electron beam irradiation facility, ACT, of National Institute for Fusion Science. The sublimations of boron and carbon contents were measured after the heat load tests. The maximum surface temperature reached up to 2400 °C in a case of highest heat flux.

The sublimation amount both for carbon and boron were large for the bulk boronized grapnite with large boron content. In the early stage of the beam irradiation, the boron sublimation was dominated. Then, after most of the boron evaporated, the carbon sublimation occured.

In order to confirm the boron sublimation, the depth atomic composition was measured by using AES. In addition, the surface morphology after irradiation was examined by SEM.

RADIATION-INDUCED SEGREGATION IN FE-CR-NI ALLOY BY ELECTRON/HELIUM ION DUAL BEAM IRRADIATION

Y. HIDAKA, S. OHNUKI and H. TAKAHASHI

(Received June 28, 1993)

Abstract

To investigate the effect of Helium on radiation induced segregation, dual-beam lrradiation with electrons and Helium ions has been carried out for an Fe-Cr-Ni model alloy using a 1300 keV high voltage electron microscopy (HVEM) and 300 keV ion-accelerator. The depletion of Cr and the enrichment of Ni were recognized at the grain boundary by EDS analyses, and depletion of Ni and enrichment of Cr were also detected in the irradiated area in the grain. In the case of dual-beam irradiation the segregation of Ni and Cr were reduced, compared to electron single-beam irradiation at all of the irradiation condition with Helium (20 and 70 appm/dpa). The dislocation and void densities were higher at the dual-beam condition than those at single electron condition. In addition, the activation energy of vacancy migmation tended to increase by binding of vacancy with Helium. This means that the sink effect of void and dislocation on reduction of effective point defect concentration and the decrease of diffusivdty of vacancies which are associated with solute diffusion suppress the segregation of solutes.

NOTICE

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Properties of a Set of Minimal Solutions for a Fuzzy Relation Equation

Masaaki MIYAKOSHI Hideyuki IMAI and Tsutomu DA-TE

(Received August 31, 1993)

Abstract

A fuzzy relation equation (hereinafter abbreviated by f. r. e.) is closely related to fuzzy inference or fuzzy control and hence it is of applicational importance. Also, from the mathematical viewpoint, the set of all solutions of an f. r. e. is interested because of its algebraic structure.

Especially, for a finite f. r. e., defined on finite index sets, we may recapitulate the following remarkable results: (i) the existence condition of a solution for a finite f. r. e., (ii) the existence condition of minimal solutions for a finite f. r. e., and (iii) the set of all solutions is completely determined by the greatest solution and the minimal ones.

On the contrary, if the cardinal numbers of the index sets are greater than or equal to the countable infinity, the minimal solution(s) may exist or may not. The condition under which the minimal solution(s) can exist for a general f. r. e. is not yet given.

In this paper, we present some properties of the set of the minimal solution(s) of a general f. r. e. using the attainability (unattainability) of a solution. These properties may give us some fundamentals for the existence condition of the minimal solution(s) for a general f. r. e.

The Fuzzy Clustering Algorithm Based on the Properties of the Weighting Exponent

Hideyuki IMAI, Yasuo MIYAZAWA,
Masaaki MIYAKOSHI and Tsutomu DA-TE

(Received August 31,1993)

Abstract

In the fuzzy c-means algorithm, proposed by Bezdek and Dunn, the fuzziness of the grade of membership depends on the weighting exponent. Though one must choose the exponent to use the fuzzy c-mean algorithm, no theoretical basis for the optimal exponet is known.

In this paper, we discuss the properties of the weighting exponent by numerical experiments. And we propose the fuzzy clustering algorithm based on these properties. Moreover we propose the graphical representation method for clustering.

Analyzing Object-Based Concurrent Models using Language Embedding

Shin-ya WATANABE Kiyoshi AKAMA and Eiich MIYAMOTO

(Received September 31, 1993)

Abstract

We have tried to construct a translator which compiles Actor programs into programs based on the Theory of Generalized Logic Programs. It is a part of the trial that integrates a variety of programming languages onto one general theory.

This translator enables us to understand the concept of concurrentprogrammings from the viewpoint of GLP theory. Moreover, it enables us to compare the concepts of Actor with those of other concurrent modelson GLP theory, and also enables us to apply the theory of program transformation to Actor programs.

Distributed Cooperative Information Retrive over the Internet

Kazufumi MITANI, Fumitake SAITO,
Tetsuro YOSHIMOTO, and Eiichi MIYAMOTO

(Received August31, 1993)

Abstract

There are many information resources which are shared among the people on the Internet. These resources vary both in quality and quantity. NetNews, a distributed BBS system, is one of the most common use in the Internet. In this paper, we propose a new method to manage each information in NetNews and introduce a search method to obtain the desired information over the Internet. Adding a uniq increasing densely number to each NetNews articles makes NetNews System more fault-tolerant. Simulation of 100 nodes network shows that a backet-relay search of NetNews articles with newly devised caching system is useful and tolerable on the Internet.

Recognition of Vowels and Semivowels by Time-Dependent Parameters.

Jun TOYAMA and Masaru SHIMBO

(Received August 31, 1993)

Abstract

Vowels are classified on the plane with coordinate axes of two lower formant frequencies, i.e., F_1-F_2 plane. On the other hand, since semivowels are acoustically similar to vowels, it is hard to discriminate the former from the latter. Based on the fact that the time transitions of peak frequencies and peak powers of semivowels are different from those of vowels, we propose a method to discriminate vowels from semivowels using newly defined time-dependent parameters corresponding to the foregoing time transition characteristics. In an experiment, we discriminate five Japanese vowels and three semivowels with the recognition rate of 84.6% for 4,554 phonemes uttered by three male speakers.

Computational Complexity of Subclass Problems

M. Kudo and M. Shimbo

(Received August 31, 1993)

Abstract

When training samples of several classes in an Euclidean space $\mathbf{R}^n$ are given, to find boundaries in $\mathbf{R}^n$ in such a way that they include only samples of a certain class is one of the most important issues in the field of pattern recognition. A subclass problem is one of such problems where boundaries are limited to hyper-rectangles. This paper evaluates the computational complexity of the subclass problem and shows that the problem is NP-hard.

Reflective Computation in Term Rewriting Systems

Masahito, KURIHARA, Taka-aki SATO and Azuma OHUCHI
(Received August 31, 1993)

Abstract

Reflection is a mechanism that makes computational systems highly flexible by allowing them to manipulate meta objects that represent the current state of its own computation. We propose Reflective Equational Programming System (REPS), which is a framework for programming languages based on term rewriting systems equipped with reflective facilities called reification and deification. The arguments of a redex, the context around the redex and the current set of rewrite rules are considered as meta objects in REPS, and by the reification operation they are transformed into constructor terms considered as base-level objects. The deification operation transforms base-level constructor terms into meta objects.

FISM/* : An Integrative Idea Generation Supporting System

Azuma OHUCHI
(Received August 31, 1993)

Abstract

This paper introduces a new idea generating support system FISM/* based on an emerging methodology which appears to be very useful as an aid to individuals and groups in making an decision of various problems. This paper presents an introduction to the fundamental concepts and operations of FISM/* and reports on the result of an exercise conducted with a group of some members. The results of the exercise demonstrates the utility of the methodology for supporting idea generation of complex issues.

Transmission of Animation of Sign Language by a Communication Satellite

Yoshinao AOKI, Shin TANAHASHI, Jun Xu and Tomoaki MURABAYASHI

(Received August 31, 1993)

Abstract

We propose a communication method to transmit sign language image by a communication satellite, where animations corresponding to the sentences of sign language are transmitted. Since a transmission line of a large capacity is necessary for animation transmission of sign language images, we adopt a method of an intelligent communication transmission to reduce capacity of image data, where a computer graphics (CG) system reconstruct sign language image after receiving textual data or parameters describing the hands and fingers motions. We propose a method to draw sign language images according to the textual data or parameters and develope a CG system to construct animation of sign language images by combining the CG-generated sign language images. An experiment using a communication satellite was done to verify the effectiveness of the developed system for sending animation of sign language images, resulting in showing the potentiality of the developed system.

Color-Based Region Extraction Using Splittable Active-Net

Kazuyoshi YOSHINO, Mio MAKI,
Toshio KAWASHIMA and Yoshinao AOKI

(Received August 31, 1993)

Abstract

In this paper, we propose color-based region extraction algorithms using splittable active-net. In the algorithms, we use *histogram backprojection function*, which maps the color of a image pixel to the ratio histogram of the target, as the image energy of splittable active-net. The convergency of splittable active-net is improved by determining its initial position by rough estimation of the target. Additionally, we extend the histogram backprojection function to team identification tasks to apply the algorithms to multiple-team-multiple-target images. The validity of our approach is shown by the experimental results for soccer T. V. programs.

Measurement of User's Action and Analysis in Human Interface Design

Hidetoshi NONAKA and Tsutomu DA-TE
(Received August 31, 1993)

Abstract

Measurement or detection of user's action is necessary for computer to communicate with user. But it is usually achieved with keyboard and mouse in uniform and inflexible manner, then user is obliged to practice in handling them in order to communicate fluently with computer. In this paper, we present new methods for measuring user's action. They are effective for making variety of communication, which makes human interface friendly. Firstly ultrasonic position measuring method is introduced, and performance test of the method is discussed. Secondly the principle of video system with motor vision and its construction on an experimental basis are introduced. Thirdly detection method of lifting action is described and inertia-mouse is introduced. Finally pointing systems using ultrasonic position measuring are realized. They are verified to be suitable for practical use by performance test.

A Generalization of Hybrid Fuzzy Arithmetic

Mayuka F. KAWAGUCHI and Tsutomu DA-TE
(Received August 31, 1993)

Abstract

Our study focuses on a hybrid fuzzy arithmetic involving nonstandard operations on fuzzy numbers. Nonstandard operations with effect of reducing fuzziness were introduced by Sanchez as a procedure to solve fuzzy arithmetic equations. Moreover, he proposed a hybrid fuzzy arithmetic in which ordinary operations on fuzzy numbers (i. e. sup-min convolution) are combined with nonstandard operations based on the implication operator associated with min operator. On the other hand, Dubois & Prade generalized a fuzzy arithmetic by replacing min operator to t-norm T which is a family of functions including min operator. A merit of this method (i. e. sup-T convolution) is that it is possible to regulate the increase of fuzziness according to choice of t-norms.

The authors extend a hybrid fuzzy arithmetic according to the generalization of fuzzy arithmetic by Dubois & Prade. In other words, we present a generalized hybrid fuzzy arithmetic which consists of ordinary operations based on a t-norm and nonstandard ones based on the implication operator associated with the t-norm. As the main result of this work, all properties of the hybrid fuzzy arithmetic corresponding to min operator are shown to hold, also in the case of a family of lower semicontinuous t-norms.

A data analysis supporting system with TMS

Hiroyuki MINAMI, Masahiro MIZUTA and Yoshiharu SATO
(Received August 31, 1993)

Abstract

Most data analysis systems seem to be convenient for statisticians, but novices in statistics can not use them easily since it is hard to select appropriate procedures according to data and purpose.

We had already proposed the data analysis supporting system with the techniques of knowledge processing but there remains a problem about the efficiency of reasoning. Since the reasoning method depended on Prolog system completely, we processed some unnecessary steps.

TMS(Truth Maintenance System) is one of the assumption based reasoning methods. We offer a data analysis system with supporting function based on TMS and show an example of execution.

A Genetic Scheme for Distributed Dynamic Load Balancing

Masaharu MUNEMOTO, Yoshiaki TAKAI, and Yoshiharu SATO
(Received August 31, 1993)

Abstract

A distributed computing system (DCS) is a collection of autonomous computers which are loosely coupled via a communicating network. Efficiency of DCS depends on how even the processors' loads are distributed. A dynamic load balancing scheme distributes tasks while their execution.

We propose a distributed dynamic load balancing scheme which improves performance of a conventional sender-initiated algorithm by using genetic operators based on a genetic algorithm (GA). In our scheme, genetic operators are applied to a population, a multiset of strings, assigned to each processor in a DCS. A string in the population represents a set of processors to which requests for task migration are sent. Through empirical investigations, we show the effectiveness of our scheme compared with the sender-initiated algorithm from a view point of the mean response time of input tasks.

Forecasting Travel Demand for the Induced Traffic Volume in the Intercity Transport

Kiyoshi TAKAHASHI, Shin'ei TAKANO,
Keiichi SATOH, Hideo IGARASHI
(Received August 31, 1993)

Abstract

The objective of the study is to build the induced traffic volume by using information flow. For planning the intercity transport system, it is very important to consider the travel demand forecasting. The paper describes the estimation of a logit model between induced the traffic volume and the appearent traffic volume, for traffic resistance. Next, we built the modal spilit model, where the data used for model estimation were obtained from the intercity traffic volume. We try to predict the future traffic volume in the intercity transport between Sapporo and other main cities in Asahikawa. This conclusion contributes to the intercity traffic system in Hokkaido.

Approximate model following control for nonlinear systems

M. YOKOMICHI[1] T. UEDA[2] Y. ISURUGI[1] and M. SHIMA[1]
(Received August 31, 1993)

Abstract

In this paper, an approximate model following control of SISO nonlinear systems which are fail to have relative order is considered. For such systems, the model following control law proposed by Isurugi and Shina. can not be used. Thus the authors apply the approximate input-output linearization approach which is studied by Hauser *et. al.* to model following control problem. If the plant satisfies some conditions, it is possible that the output of the plant follows that of the model with small error.

Output tracking control for nonlinear singularly perturbed systems

Y. YAMASHITA[1], N. KISHI[2], and M. SHIMA[1]

(Received August 31, 1993)

Abstract

In this paper, output tracking control problem for nonlinear singularly perturbed systems is concerned. A singularly perturbed system consists of both *fast* and *slow* dynamics. If the fast dynamics — *bounded layer system* — is stable, states of the system converge to a *invariant manifold* rapidly. By means of the invariant manifold, *reduced order system* can be derived. First of all, a feedback law for the fast dynamics is designed, that attains stabilization and state-linearization of the bounded layer system. Then Jacobian matrix of the bounded layer system is constant, and the 0th order approximation of the invariant manifold is described by linear function of secondary-input. Secondly, a feedback law which that output of the reduced order system follows a reference input is obtained. Stability of closed system is guaranteed by Tikhonov's theorem for sufficiently small perturbation. The feedback laws for the fast dynamics and the slow dynamics are synthesized nonlinearly, while Kokotovic's method uses linear combination. The nonlinearity makes the fast dynamics linearizable.

On semantic representation and data storage for natural language processing

Yoshitaka SATO Yoshikazu MIYANAGA Koji TOCHINAI

(Received August 31, 1993)

Abstract

According to the rapid increase of computer power and cost performance, a large number of studies on natural language processing are carried out. However, many problems are not yet settled. For example, integrated language processing systems, such as, machine translation systems or dialogue understanding systems need a large amount of knowledge or rules. Relationships for these data must be described with no contradictions, and it is generally required a great deal of labor to construct a whole set of those knowledge and rules.

In this paper, we propose a method to construct a network structure for a semantic group of sentences combined with syntax trees of them. In this network, local classes of concepts in the sentence group can be constructed from nouns, and relations of concepts are expressed by verbs.

We also propose a procedure for data structure construction and an efficient method for getting data. These methods use mutual dependence or interactions between grammatical categories and syntax rules, and a hierarchical structure of data for three levels—that is, paragraphs, sentences, and words are combined.

Impremention of Document Editor for Natural Language Processing.

Masakatsu TSUTSUMI Kenji ARAKI
Yoshikazu MIYANAGA and Koji TOCHINAI
(Received August 31, 1993)

Abstract

In this paper, we discuss about the implementation of a document editor which has three purposes.

The first purpose is following. Voice recognition is a simple way to input documents. However its method is not established. On this problem, we had supposed a method to recover original character strings from voice-recognized erroneous strings. This method is somewhat statistic one. So we need statistic information of morphic words from a large number of existing document files. In order to get the statistic information, we cannot use full-automatic morphic analysis, because those files must have some errors. Therefore we propose an editing algorithm, and implement it as a half-automatic analizer.

The second purpose is following. It is destiny of voice recognition to include error. So, a voice input system needs to provide not only the voice recognition, but also keyboad input correct errors. In addition, using the editor's function of gradual entry enables to cope with unentried words.

The third purpose of the editor is following. Since edited error-free documents can be useful for various studies of natual language processing, we consider to prepare a morphic saving format. And we refer to its description and grammar.

Visualization of Time Varying Volume Data

Tsuyoshi YAMAMOTO
(Received August 31, 1993)

Abstract

Scientific Visualization, an application of computer graphics techniques to produce pictures of complex volume image and physical phenomenon, is emerging as a very powerful means of enabling scientists and reserchers to interpret their data. In many applications of scientific visualization, source data to be visualized are unorganized data set such as volume metric data and many new techniques have been developed last 10 years. These techniques are generalized to volume rendering method. However, most of these techniques are considering only three dimensional volume that are taken from still organs such as brains or bones. Rescent development of three dimensional scanners makes it possible to measure moving organs as heart.

In this article, I would like to introduce volume ray tracing method to visualize four dimensional volume metric data. The results of visualization from live human heart beat are shown.

A feature extraction method for classifying textures in natural scenes

Toshinori HAYASHI, Yuzuru TANAKA
(Received August 31, 1993)

Abstract

The difference of lighting condition and imaging process often makes a variety of images from the same object. We need a feature that can indicate types of objects rather than types of images. In texture analysis, fractal dimension was used to extract features from images in natural scenes. But none of them succeed in classifying images according to types of object such as woods, grass, and so on. In this paper, we propose new image feature called granularity dimension that is invariant to scaling and contrast change. We also develop an algorithm to extract this feature from images.

A Study on Problem Solving Using Analogy

Kenichi MATSUURA and Yukinori KAKAZU
(Received August 31, 1993)

Abstract

To solve a given problem, the strategy that is suitable for solving that problem is used in general. This strategies for solving a problem can be treated as a mapping from the problem into a solution. Besides, there will exist some kinds of analogical relationship among these strategies. Thus, we can apply the method, that takes analogy of strategies with the problem that has already been solved and that is similar to the unsolved problem, to find unsolved problem. In this paper, we attempt to perform problem solving using such analogical method. To this end, first, heuristics are generated by generalizing a set of problem solving strategies that are similar to each other. Second, these heuristics are applied to the targeted problem and a solution is found. We have performed some computer experiments to examine the role of the heuristics and the effectiveness of the analogy.

Inference of Programs by Stratifying Recursion

Akira ISHINO and Akihiro YAMAMOTO
(Received August 31, 1993)

Abstract

This paper describes a procedure which learns functions represented by a class of Scheme programs, called stratified recursive programs. It accepts examples as inputs and outputs stratified recursive programs as conjectures. It is a data-driven procedure and does not use any enumeration. It is based on the method 'THESYS' that was shown by Summers, but includes the power of generating intermediate new functions by computing differences of program fragments.

Simulation of Electromagnetic Fields by Generalized Spatial Network for Vector Potential

Norinobu YOSHIDA
(Received August 31, 1993)

Abstract

In the analysis of electromagnetic fields, the vector potential has important roles especially when sources exist and quantum effects are considered. I have recently proposed a new numerical method for unified analysis of the three-dimensional vector and scalar potential fields on the time domain. The method is based on the Spatial Network Method (SNM) for the Maxwell's equations, in which the use of both equivalent voltage and current variables have the capability of treating the boundary and medium conditions by the equivalent lumped elements at nodes. In the formulation of the vector potential fields, both the magnetic and the electric vector potentials are used to give the fundamental equations to be similar to the Maxwell's equation. Therefore, those advantages in SNM can be inherited. In this paper, this advantages are verified by showing the treatment of typical boundary conditions in a waveguide and the dispersive properties of resonance absorption. It is also shown that the correspondence of the continuity law for the equivalent currents to that for the electric or magnetic flux can simplify the expression of the medium conditions. This property indicates that the spatial network functions as a general network correspondent to each expression of electromagnetic fields.