Title	Abstracts & Titles, No. 104-107
Citation	Memoirs of the Faculty of Engineering, Hokkaido University, 16(1), 67-100
Issue Date	1982-12
Doc URL	http://hdl.handle.net/2115/38005
Type	bulletin (other)
File Information	16(1)_67-100.pdf

Appendix

Abstracts & Titles, No. 104~107

BULLETIN
OF THE
FACULTY OF ENGINEERING
HOKKAIDO UNIVERSITY
NOTICE

No. 104   May 1981

Control of Thermal Sweating and Comfort Sensation of Man

Tohru MOCHIDA

(Received December 27, 1980)

Abstract

A comfort diagram is proposed as an index of comfort sensation and for the evaluation of the thermal environment based on a rational heat balance equation. The four main channels of heat exchange are considered from an engineering viewpoint. For radiation heat loss, by extending Gebhart's absorption factor and applying it to the space between the human body and the surrounding walls, a new coefficient of radiant heat transfer is derived. A convective heat transfer coefficient for the human body is also derived based on the heat and mass transfer theory. For the evaporation heat loss from the skin surface, a new model is proposed, i. e., a model is based on that the evaporation heat loss would be inversely propotional to the wettedness and that wettedness would vary even on an equal thermal sensation line. The characteristics of the proposed model were verified by comparing calculated values with physiological data observed in the experiments and the indices given by earlier workers. Lines of comfort sensation can be drawn based on the heat balance equation derived and a control rule of perspiration. The proposed comfort index is prepared for some relevant combinations of variables concerned, namely, clothing insulation, metabolic rate and air movement.

Effects of Cutting Conditions on the Vibration of the Chain Saw

Tadahiko KANAUCHI, Yoshio YAMASHITA,
Masahiro OHSHIMA, Shigemoto TAZAWA
(Received December 27, 1980)

Abstract

In felling timber, the chain saw has been widely adopted. Operators of chain saws, have experienced physical disability in hands and arms, due to the vibration and the transmissive force of the saw.

The present investigation was carried out as a first step to determine clearly how to reduce excessive vibration and transmissive force and to render the chain saw safe as a hand tool.

This paper describes preliminary experiments on the acceleration and transmissive force to the arms and gripping force to the handles under various cutting velocities.

Although a higher acceleration occurs with higher cutting velocity, increase of the velocity appears to have no consistent effect on transmissive force.

Tighter gripping of the handle reduces the acceleration of vibration, yet, at the same time the transmissive force to the arms increases.

Under low velocity, high values of transmissive force are measured in the vertical direction, due to the unstable rotation of the engine.

Cutting force increases the acceleration under relatively low revolutions, however, decreases under high revolutions.

There is a linear relation between the transmissive force and the feed per one cutting tooth of the saw.

An Analysis of a CVS Multiberth Station Model
by means of the Markov Renewal Theory

Masahito KURIHARA, Katsuhiro NAKADA and Ikuo KAJI

Abstract

CVS (Computer-controlled Vehicle System) is a traffic system where most of the stations are small and have only one berth, on which detailed stochastic studies have been reported. In case of heavy traffic, however, the single-berth station would not have enough capacity to satisfy this heavy demand. This leads one to consider a station which works with a number of berths, while no reports can be found on this subject.

In this paper, a stochastic model is developed which can treat such a multiberth station, through the analysis of which some basic characteristics are exposed that depend on the number of berths.

Ionization Current Growth and the Ionization
Coefficients in N_2 and CH_4 Mixtures

Mitsuo SHIMOZUMA, Hiroaki TAGASHIRA and Hideki HASEGAWA

(Received December 27, 1980)

Abstract

A N_2 and CH_4 gas mixture is often used in the investigation of the electrical breakdown process by a high speed camera. The Townsend first ionization coefficient and the Townsend total secondary ionization coefficient (α / p_{20}, γ_T) in mixtures of N_2 and CH_4 have been measured by the steady state Townsend method for $40 < E/p_{20} < 500$ V cm^{-1} $Torr^{-1}$ ($121 < E/N < 1520$). According to the experimental results, α/p_{20} of the mixtures lies in between the α/p_{20} values of the respective pure gases. α/p_{20} of the mixture can be represented by a linear function of the fractional CH_4 partial pressure k for $E/p_{20} < 100$, but this linear relationship tends to break down at higher E/p_{20}. The results also show that γ_T of the ($N_2 + (10\%)CH_4$) gas increases with E/p_{20} but decreases rapidly with k for a fixed E/p_{20}. A possible explanation of this rapid decrease is given in terms of quenching of an excited state of the N_2 molecule by the CH_4 molecule.

Identification of a Pressurized Water Reactor
Power Plant by an Auto-regressive Method

Masashi TSUJI, Yukio NARUMI and Yuichi OGAWA

(Received December 27, 1980)

Abstract

With the progress of installation of nuclear power stations, a grid frequency must be controlled by the aid of optimum load following operation of nuclear power stations. To practice such an operation, we must obtain an accurate mathematical model which represents the dynamical characteristics of the nuclear power plant in a considerably simple form, and apply an effective optimum control theory to the model. An application of the identification theory based on a statistic approach such as the auto-regressive (AR) method may provide the above mentioned model, because the identification model usually grasps the characteristics of the system on the main issue and will meet the purpose of a control.

In this report, an attempt to produce the model of a very concrete pressurized water nuclear power reactor (PWR) plant by an AR model is conducted and the feasibility of the identification is discussed with some other technical problems.

The nuclear steam supply system (NSSS) which includes the reactor core, the primary cooling system, the secondary cooling system and the steam generator is regarded as an unknown system and is identified by the AR method, and the remainning part of the system, namely the turbine-generator system, is considered as a known system from accumulation of technical experiences, and is expressed by the AR model based on an analytical method. By combining the above two models, the AR model of the total system is obtained. The adequacy of the model is confirmed from the comparison between the state of the model obtained from one step prediction and the actual state.

Electrochemical Measurements of Zinc Phosphate Solution

Zhen-Uyan JIN,   Toshiaki OHTSUKA,   Norio SATO
(Received December 27, 1980)

Abstract

Measurements of pH and electrochemical potential of zincphosphating solutions were made in a temperature range from 25°C to 85°C for the purpose of establishing a monitoring technique of the solution property. Platinum electrodes are applicable for the measurement of the potential of the redox system in the solution even at 85°C and can detect the difference in the redox potential of the solution at different stages of the zinc-phosphating operation. The solution pH, measured with a glass electrode for high temperature, remains constant at a value of about 2.3 at 85°C during the operation. It is also found that the potentials of iron and zinc electrodes change with time corresponding to the growth of zinc phosphate film. From the potential change of iron electrodes it is suggested that the film formation is completed within 3 minutes at 85°C in the zinc phosphate solution for industrial use.

Study of Segregation in Alloys Irradiated by Ions and Electrons

Taro TAKEYAMA, Soumei OHNUKI
and Shigeki MARUYAMA

(Received December 27, 1980)

Abstract

Radiation induced segregation on binary alloys, 316 stainless steel and ferritic alloys was studied by means of an energy dispersive X-ray microanalyzer attached to a 200 kV STEM. Irradiation was carried out in a 650 kV high voltage electron microscope up to 10 dpa for binary alloys and in 200 kV C^+ ion accelerator up to 57 dpa. The segregation was observed on internal sinks, such as grain boundaries, voids, dislocation loops and precipitates. Radiation induced precipitation was caused by the segregation in unsaturated alloys. The type of segregation or depletion depended primarily on the difference of the size factor. However, unexpected segreration was detected in some alloys irradiated by ions. The segregation and depletion of the solutes could be affected by the nucleation and growth of voids.

NOTICE

No. 105　　　July 1981

Corrosion of Aluminum–Copper Alloy and Inhibition Action of Benzotriazole, Tolyltriazole and Hydroquinone in Sodium Hydroxide Solutions

Takenori Notoya and Tatsuo Ishikawa

(Received March 31, 1981)

Abstract

The corrosion rates of an aluminum–copper alloy (2024, Super Duralumin) in sodium hydroxide solutions of seven different concentrations were determined gravimetrically at 30℃. The influence of three organic compounds, hydroquinone (HQ), benzotriazole (BTA) and Tolyltriazole (TTA), on the corrosion behavior of the aluminum–copper alloy was investigated in a concentration range from 0.01 to 0.1 mol/1 of sodium hydroxide solutions. The corrosion of the alloy was found to be strongly dependent on the pH level of the alkaline solutions, and additions of these compounds resulted in a decrease of pH of the solution and thus leading to the decrease of its corrosion rates. The corrosion tests using a solution of constant pH (=12.8) showed that the inhibition efficiency increased with the increasing concentration of the compounds and the maximum inhibition efficiencies of HQ, BTA and TTA at a concentration of 0.1 mol/1 were 40, 13 and 16 %, respectively in 0.1 N NaOH solutions. The inhibition mechanism was discussed in relation to the nature of the corrosion product layer formed on the metal surface.

Carbon Monoxide from Town Gas Burning with a Home Use Heater set in a Poorly Ventilated Room

Kenichi Ito and Kiyotaka Yamane

(Received March 31, 1981)

Abstract

Carbon monoxide formation from a gas burning heater for home use set up in a poorly ventilated room was studied. Test room used was a 1/10 scale model and with

a volume of 1 m³. Town gas (6B) and LPG were burned using a semi-premixed burner set up in the test room. An aerated and a confined burner were examined with various loads, primary or secondary air ratios, and ventilation cycles. O_2 and CO concentrations in the room and those in burned gases were measured.

The results showed that O_2 in the room continues to decrease until the flame blows off, and that extreme CO formation occurs at an early stage when the load is larger or the air ratios are smaller. In a burner condition which gives a slow decrease in O_2 concentration and a late blow-off, the resulting CO in a room increases and becomes a hazard. LPG burning gives a small amount of CO because of early blow-off.

An Experimental Study on the Main Flame Stability of a Premixed Concentric Jet Flame

Kenichi Ito, Setsuo Tatsuta and Fuyuhiko Takahashi

(Received March 31, 1981)

Abstract

The blow-off mechanism of the main flame in a premixed concentric jet flame with a recirculation zone was studied experimentally. The detailed thermal structure of the recirculation zone and the chemical reaction processes at flame necking region between the recirculation zone and the main flame were examined. Propane-air mixture was ejected from a burner nozzle which had an inner diameter of 12 mm and a rim thickness of 7.5 mm, and a parallel air flow surrounded the burner nozzle coaxially.

In the case of a stable flame, it was found that the maximum temperature in the recirculation zone was located in the downstream region, and that the burning fraction at the flame necking region decreased near the conditions where the main flame blew off. The results of fluctuating temperature measurements at the flame necking region showed that RMS values had two peaks at both mixture side and parallel air side in the stable flame, while there was no peak at the mixture side with the near blow-off flame.

Digital Control of Induction Motor with Current-Fed Inverter

Shigeta UEDA, Shoji FUKUDA, Akio NII

(Received March 31, 1981)

Abstract

A DC motor is one of the typical variable-speed motors. But it has several drawbacks, in that it has brushes and a commutator which requires maintenance. The common trend today is to aim at maintenance-free, adjustable AC motor driving. Especially induction motors are in demand because of its simplicity and durability.

With the advent of the microprocessor technique, it is now applied to the motor speed control. Using a microcomputer as a control computer, the flexibility on the control increases. And using a current-fed inverter as a variable-frequency power source, regenerative driving becomes easy by only one converter. Hence combining V/f constant control with slip frequency control, a high efficiency four-quadrant driving of an induction motor based on primary frequency control has been developed.

In this paper the method of such driving is mentioned, and the results of the experiments and the tests are given.

Studies on the Stability of a Commutatorless Motor under $I_f - \beta_0$ control

Masamichi URANO Shoji FUKUDA Akio NII

(Received March 31, 1981)

Abstract

An induced voltage commutated commutatorless motor has the disadvantage of a small overload capacity due to the influence of armature reaction in comparison with a DC motor. The overload capacity is improved by $I_f - \beta_0$ control method, which controls the field current I_f and the preset leading angle β_0 in accordance with the load current and eliminates the armature reaction flux in a corresponding fashion.

In this paper we treat a DC source commutatorless motor with damper windings, and discuss the stability of the system under $I_f - \beta_0$ control by means of non-linear simulation and root locus method, and confirm the results by experiments.

Breakdown Process between Parallel Plates in Nitrogen, Air and Sulphur Hexafluoride.

—Observation of the Streamer Propagation by use of a Time Resolved high Speed Camera—

Nobuyasu SATO, Sadao SAWADA and Hiroaki TAGASHIRA

(Received March 31, 1981)

Abstract

An image converter and image intensifier were used to investigate the streamer propagation mechanism of transient discharges that are started at undervoltages by supplying a large number of initial electrons at the cathode of parallel plates in nitrogen, air and sulphur hexafluoride. The streak photographs and corresponding current growth curves obtained in nitrogen and air for undervoltages up to 8% at pressures in a range from 20 to 400 Torr demonstrate that the pre–breakdown stage of development was first observed in the mid gap after the accumulation of the space charge caused by the generation mechanism of the avalanches and the development of the glow discharge consists of the cathode–and anode–directed luminous fronts. Transition of the glow discharge to the arc channel was recognized in nitrogen and air at a pressure of more than 300 Torr and only a filamentary arc discharge was observed in SF_6 at a pressure of 150 Torr. The mechanism of the luminous front propagation and of the arc initiation are discussed with an account for the space charge effect and dissociation of the sample gas.

High–Speed Holographic Radar System using by Parallel Microprocessors

Kunio ONDA, Toshifumi KUNIMOTO,

Fumiaki DOBASHI Yoshinao AOKI

(Received March 31, 1981)

Abstract

A high–speed holographic radar system is described, where a parallel processing technique is used to execute the FFT operation. An experimental system was constructed with a receiving module, an array processor module, a display module and a control module. The control module has a 8–bit microprocessor and it controls other modules.   The receiving module has 32 receiving antennas and an A/D (analogue/Digital) converter.   Holographic radar data are collected and digitized with this module.   The array processor module is constructed with 4 microprocessors and it executes the FFT operation in parallel.

In the experiment a microwave of 10 GHz was used and a simulated radar image was displayed on CRT an a reconstructed image of an object made of an aluminum plate.   The speed of processings is about 70 msec for the 64 point FFT operation and 200 msec for obtaining one frame of the one–dimensional reconstructed image.

Si MIS Solar Cells by Anodization

Junji NANJO Hidekazu YAMAMOTO Hideki HASEGAWA

(Received March 31, 1981)

Abstract

The formation of thin insulating layers by anodic oxidation was investigated in the present paper as an alternative way of fabricating low-cost silicon MIS solar cells. Anodization was performed both in constant voltage mode and in constant current mode, using a ethylene glycol solution of KNO_3. The film thickness was carefully determined by an ellipsometer at the wavelength of 6328 Å. Evaluation of MIS cell performance was made by comparing the open circuit cell voltage V_{oc} and the short--circuit current density I_{sc} under illumination with a tungsten lamp and those of the bare Schottky cells (without anodization).

It was found that anodization in either mode can increase V_{oc} without reduction of

I_{sc}, but that anodization in the constatnt voltage mode is more controllable and more reproducible than that in the constant current mode. A maximum of V_{oc} of 0.52 V as compared with that of 0.37 V of the Schottky cell was achieved at the empirical optimum formation voltage of 0.5 V in the constant voltage mode. A brief discussion on the mechanism of V_{oc} increase is also made.

Study on the Calculation of the Localized
State Distribution in GD a–Si : H

Takaaki Noda Yoshihiko Ogawa Teiichi Kurobe

(Received March 31, 1981)

Abstract

The reliability of the FE method and the CV method for determining the localized state distribution $N(E)$ in GD a–Si : H are evaluated by computer simulation. It is shown that calculation by the CV method is almost exact and the FE method is less reliable. But the FE method may be more reliable than the CV method regarding the accuracy of measured values. The new calculation method combining both methods and the iteration method are suggested for obtaining an almost true distribution $N(E)$. And the effect of surface states on calculation of $N(E)$ is evaluated; the allowable surface state density is shown to be below $10^{11} \text{cm}^{-2} \text{eV}^{-1}$. The effect of the Fermi –Dirac distribution function $F(E)$ at room temperature is estimated. The result indicates that correction by room temperature $F(E)$ is necessary.

Image Segmentation Using Co-occurrence Matrix

Tatsuya ISHIKAWA, Tetsuo SHIMONO
Hideo KITAJIMA, Teiichi KUROBE
(Received March 31, 1981)

Abstract

In this paper, we discuss a new image segmentation method using co-occurrence matrix, because segmentation methods using edge points or histogram slicing proposed in the past cannot be applied to images that contain large textural regions.

In the method presented here, we consider textures to be the expansion of edges and treat the co-occurrence matrix as an experiment of probability transition matrix. We estimate the histogram from the co-occurrence matrix under the conditdon that the image is stationary from statistical point of view. The estimated histogram contains second-order statistics that is necessary for the discrimination of texture.

If we compare the original histogram with the estimated one, the relation between each gray level and texture is obtained. When the difference at a gray level is relatively large, we decide that the pixels having the level are contained in the textural region.

Furthermore, two-dimensional features for image segmentation are obtained, and they can be applied for the detection of the textural edge and transformation of gray scale image into a binary image.

Evaporation Rates in Falling-Film and Climbing-Film Evaporators Heated with High Humid Waste Gas

Osamu UEMAKI,   Masahisa FUJIKAWA,
Noboru WATANABE,   Masao KUGO
(Received March 31, 1981)

Abstract

An application of high humid waste gas from a dryer was experimentally investigated as a possible heating media of a vertical liquid-film type evaporator. Highly humidified air of 0.5 (kg H_2O/kg dry air) and 120 ℃ were estimated for humidity and temperature of the exit gas for the dryer of filtrated stock. The evaporation rates of

water were measured in two falling–film evaporators and a climbing–film evaporator. The temperature of the outlet gas was 59-64 ℃ corresponding to the boiling point of 55 ℃ of the evaporators controlled at 120 mm Hg abs. pressure. But in this experiment the inlet temperature of gas was somewhat lower than 120 ℃ by $40-45℃$, because the gas was expected to pass through a heat exchanger to heat other stock.

The results indicated that the evaporation rates were $8-12$ (kg/m²·hr) as increased with feed rates of water up to 40 (kg/m·hr) under the constant ratio of feed rate to air flow rate. It was concluded that the efficiency of the evaporation in the climbing–film evaporator was greater than that in the falling–film evaporators.

Growth of Vanadium Dioxide Single Crystals from $V_2O_5 - V_2O_3$ System under Pressure

Kohei Kodaira, Isao Jogenji,
Shiro Shimada and Toru Matsushita
(Received March 31, 1981)

Abstract

Vanadium dioxide single crystals were grown from a mixture of $VO_x(x=2.0\text{-}2.4)$ compositions in the V_2O_5-V_2O_3 system under a pressure of 10 kbars. In the V_2O_5-V_2O_3 system mixtures, there was a solubility limit to dissolve VO_2 into liquid phase among $VO_{2.2}$ and $VO_{2.3}$ compositions at 1200℃ and under pressure. Prismatic crystals with a maximum size of $0.6 \times 0.6 \times 2.5$ mm were obtained at 1200 and 1300℃ for 4 hours. The x in VO_x of single crystals was calculated to be about 2.03. About 3×10^2 Ω–cm discontinuity of the resistivity took place at the transition point. The crystallographic direction of a long edge of the crystals was consistent with a–axis.

ESR Study of the pH Effect on Cupric Complexes in Saturated Ammonium Sulfate Aqueous Solution

K. OHNO and J. SOHMA

(Received March 31, 1981)

Abstract

The effect of pH on Cu^{2+} ion site selection in ammonium sulfate single crystals grown from mother solutions was clarified. It was confirmed that Cu^{2+} ions on substitutional sites in a crystal grown from an acidic solution originate from a $[Cu (H_2O)_6]^{2+}$ complex in the solution and at the same time ions on interstitial sites in a crystal grown from either a neutral or an alkaline solution originate from a $[Cu (NH_3)_n (H_2O)_{6-n}]$ complex in the solutions. Spin–Hamiltonian parameters were determined for $[Cu (H_2O)_6]^{2+}$ and $[Cu (NH_3)_4 (H_2O)_2]^{2+}$ complexes. The ratio of radius R, derived from the observed correlation times for the former complex and the latter was found to be 1. 7. Two trapping mechanisms to explain the site selection were proposed.

Detection of Correlation by Means of a Reflection–Type Matched Filter

En Yao ZHANG, Yukihiro ISHII and Kazumi MURATA

(Received March 31, 1981)

Abstract

Spatial matched filtering with a reflection–type volume hologram is theoretically investigated and some experiments for the detection of a two–dimensional correlation of objects are shown. The distortion of the correlation output due to the mismatching of filtering to recording wavelength is discussed. While the reflection–type volume hologram has a wavelength selectivity, a temporally incoherent illumination can be used for the filtering. A compact optical setup with a lensless spatial matched filter is also proposed. Two kinds of blurring of the correlation image due to angular and

wavelength selectivities of the filter are given. Experiments for pattern and character recognitions are carried out using a pressure–broadened mercury light.

Optimal Load–Following Control Using an AR Model of a Pressurized Water Nuclear Power Reactor Plant.

Massashi Tsuji, Yukio Narumi, Yuichi Ogawa

(Received March 31, 1981)

Abstract

With the progress of installation of nuclear power stations, it is expected that some of the stations will be required to be operated in a load-following operation as well as a base load operation. In this paper, to meet such a demand, we attempt to control a pressurized water nuclear power reactor (PWR) plant in an optimal load-following operation. For this purpose, we adopt a control which comprises the advantages of the two strategies simultaneously, that is, " reactor slaved to turbine " and " turbine slaved to reactor ". This control is carried out by linked motions of control rods and a turbine control valve in such a way as to respond to a load change effectively. An optimal load-following controller is designed by applying the dynamic programming method to an autoregressive (AR) model of the PWR nuclear power plant which was previously identified by authors.

From digital simulations, it is found that when the nuclear power plant is controlled in the optimal load-following operation by this controller, the generated electric power follows rapidly to the load change and the associated grid frequency disturbance diminishes in quite a small time.

Experimental Studies on the Estimation of the Dynamic Characteristics of the Human Operator

Yoshinori OKA, Tuyoshi TAKEDA and Masamoto NAITO

(Received March 31, 1981)

Abstract

It is important to understand the dynamic characteristics of human operators as a controller of Man–Machine System. In this paper, estimation of the dynamic characteristics of human operators in a few simple manual control systems, is discussed using an Auto–Regressive Model. Control tasks are as follows – pursuit tracking, compensatory tracking, and two–variable compensatory tracking. The transfer functions of the controlled elements are $1, 1/(0.2s+1)$, $1/(s+1)$, $1/s$, and $1/s(s+1)$.

Although the characteristics of human operators generally contain non–linearity, the authors assumed that the dynamics could be expressed by a linear model with an additional noise, regarding the non–linear part as the noise (remnant) generated by the human operator. Therefore it is shown how this additional noise is whitened by AR –model for the purpose of unbiassed estimator in spite of the existence of feedback loop. As a result, the variation of the dynamic characteristics of human operators is represented by the discrete impulse sequences.

Fluctuation Properties of a Glass Thin–Film Optical Waveguide and Its Scattering Patterns

Mamoru KOSEKI, Masaaki IMAI and Yoshihiro OHTSUKA

(Received March 31, 1981)

Abstract

Measurements were made of the light scattered out of a Corning 7059 glass thin-film waveguide sputtered onto a pyrex glass substrate. The angular distributions of the scattered light reveal that the waveguide imperfections not only of irregular boundaries of film–substrate and film–air interfaces but of refractive-index inhomogeneities could be estimated by comparing the experimental curves with the theoretical ones. For example, it was found that the measured curves of the scattered light intensity

are consistent with the theory based on the first-order approximation of perturbation, assuming a correlation length of $b_x/\lambda \sim 0.1$, $b_z/\lambda \sim 1.0$ and $G = V_f/V\lambda \sim 1.0$, where b_x and b_z are the correlation lengths in the directions perpendicular and parallel to the waveguide surface, and V, V_f are the r. m. s. values of the index fluctuations and the surface roughness, λ being the wavelength of light. In addition, a number of sample waveguides with various thickness were tested in order to gain some understanding of the loss mechanism producing the scattering from a sputtered glass thin-film waveguide.

Studies of N-Person Cooperative Games Based on the Characterizations of Weighted Majority Games

Yoko Kurino and Tsutomu Date

(Received March 31, 1981)

Abstract

We deal with a classification of simple games —— a class of games in game theory established by von Neumann and Morgenstern in 1940s, aiming at contributions to systematic characterizations of combinatorial problems. A simple game is the most appropriate class of games for the quantitative studies of behaviors in voting systems such as assemblies, committees or general meetings of stockholders etc. The majority decision rules can be characterized by constant-sum simple games, and the simple games can be expressed by weighted majority games.

In this paper, at first we give perfect classifications of constant-sum simple games with players less than eight, and improve the works of Isbell, who stated that, " For six players there are exactly 14 such games, and for seven at least 110. " Next we propose a new estimate of the number of such games, and give more simple expressions for the simple games by introducing a relation between the games and a function with one parameter.

NOTICE

No. 106   November 1981

Characteristics of a normal flat plate
in Grid-generated Turbulent Flows

Mikio ARIE, Masaru KIYA, Yasuhiro SUZUKI and Masaaki SEKINE
(Received June 30, 1981)

Abstract

The present experimental studies were performed to investigate the effect of a free-stream turbulence on the aerodynamic characteristics of a two-dimensional normal flat plate. Several square-meshed grids were used to produce a close to homogeneous turbulent flow field. Measurements were made on the time-averaged pressure distributions around the plate, the Strouhal number of the vortex shedding, the length of the vortex formation region and the profiles of the separated shear layer.

The results show that the time-averaged drag force acting on a normal flat plate increases as the turbulence increases. The length of the vortex formation region and the area of the cavity region behind the plate decreases as the turbulence intensity increases.

Study on the Combustion Performance of Stoves for Space
Heating (lst Report)
—Combustion Experiments and Analysis of the Vaporizing Pot Type
Kerosene Oil-fired Stove —

Takashi SONODA, Hiroshi TANIGUCHI, Tatsuo TANAKA, Hiroshi HAYASAKA
(Received June 30,1981)

Abstract

The purpose of this investigation is to present the results of experiments and analysis showing the heating effect and the combustion performance for several kinds of stoves, which have been used as an individual heater for space heating in residences and offices.

The lst report describes thermal efficiency,heat losses, components of emissive gas, such as CO_2,CO and NO_x, and the distribution of the surface temperatures and the radiant heat for a vaporizing pot type kerosene oil-fired stove, a typical one, with fuel consumption.

The data reported here demonstrates that the maximum thermal efficiency of this stove attains about 80% and the maximun NO_x concentration is about 80 ppm. The result of a simulation analysis by computer is also reported to obtain gas flow patterns.

Study on the Combustion Performance of Stoves for Space Heating (2nd Report)
—Combustion Experiments of each stove of hot air supply, forced flue(FF) and portable types —

Takashi SONODA, Hiroshi TANIGUCHI, Tatsuo TANAKA, Hiroshi HAYASAKA
(Received June 30, 1981)

Abstract

The 2nd report deals with each stove of hot air supply, forced flue(FF) and portable types.

The method of experiment is the same as that of 1st report. For portable type of stoves, however, the variations of temperature and components of gas in a room using stoves without ventilation are obtained.

The data reported here points out that the variations of the efficiency of hot air supply type with fuel consumption is relatively small and that of forced flue type is the largest in the stoves dealt with here. Furthermore the combustion experiment with portable type stoves shows that the concentrations of CO and NO_x in the room becomes much higher in about two hours. In using them actually it is very important to ventilate forcedly.

Charged Domain Wall Treated with Uniform Rotation of Magnetization in Fe-3%Si

Iwao ISHIDA and Hitoshi NAKAE
(Received June 30, 1981)

Abstract

Two models of charged walls are investigated. In the uniaxial model, the magnetization is assumed to rotate with the depth in wall entailing magneto-static and magneto-crystalline anisotropy energies. The biaxial model consisted of a Bloch-like region between the Néel-like regions diminishes the wall energy considerably being shared by the magnetostatic energy only in Néel-like regions. The biaxial model is considered to be an optimum model of the charged wall.

If the Bloch wall is flexible, the same is for the charged wall in the range of a tilt angle $|\theta| \leq 11.3°$ since such a charged wall energy estimated from the biaxial model is equal to an inclining Bloch wall energy.

CVS Network Simulator for Personal Rapid Transit systems under Point-follower Control

Masahito KURIHARA, Katsuhiro NAKADA and Ikuo KAJI
(Received June 30, 1981)

Abstract

We developed a simulator for CVS (Computer-controlled Vehicle System) which is classified as PRT (Personal Rapid Transit systems).

Our simulator deals with those models in which vehicles move on a guideway under point-follower control. Vehicles might enter and depart from stations, pass through intersections and join another vehicle flow.

Control programs written in a particular language developed for simple programming can be supplied to the simulator. The simulator is composed of three parts ⋯ translator, runtime routines and scanner. The translator tranforms control programs into internal codes. The runtime routines are used when vehicles execute the instructions. The scanner is the most important part. It selects each vehicle, fetches the instruction to be executed, and then decodes it. Thus the vehicle executes the instruction and changes its status. When the scanner has finished with this vehicle, it selects another vehicle. When all vehicles have been scanned, the simulation clock evolves. The scanner also exhibits vehicle flow on a graphic display.

The above principles successfully make the simulator simple, relible, flexible extensible.

Accelerator-based Cold Neutron Sources, Quasielastic Scattering Spectrometers and Investigation Using These Apparatuses

K. INOUE, Y. KIYANAGI, H. IWASA and K.JINGUJI
(Received June 30, 1981)

Abstract

Several laboratories in the world have been developing intense neutron sources using large capacity accelerators for the neutron scattering experiments. We have developed a cold neutron source using a modest capacity electron linac at the Hokkaido University, and it has been under operation succesfully over an extended period. The design philosophy developed at the Hokkaido University was adopted for the installation of the cold neutron source into the spallation neutron source at the National Laboratory for High Energy

Physics. These accelerator-based cold neutron sources are the only two which are under operation in the world at present. Furthermore two quasielatic scattering spectrometers utilizing the characteristics of the pulsed cold neutron source were developed and installed with the above cold neutron sources, and have used for the investigation of the random motions in the molecular systems. Here we describe the design philosophy, the details and operational experiences of the apparatuses, and some results of the experiments using these spectrometers.

On a Discriminant Function in the Parameter Space and its Robustness

Yoshiharu SATO, Kazuaki SUGAWA, Masahiro NARITA, Yoshimi HAYASHI
and Michiaki KAWAGUCHI
(Received June 30, 1981)

Abstract

In a family of statistical distributions, several measures for estimating the similarity of the distributions have been introduced.
C. R. Rao showed that, in a family of distributions with a parameter, the distance between the two distributions corresponding to the contiguous points in the parameter space was qiven by the quadratic form and introduced Riemmanian space as the model of the parameter space.

In this paper, for the problem of discrimination of distributions we introduce the criterion of discrimination by the metric of the parameter space and show that a sample is assigned to given distributions by the metric of their dual parameter spaces. Especially we give the method of discrimination of the exponential family and discuss the robustness of this method.

NOTICE

No. 107   January 1982

A Model on Heat Loss by Perspiration and Temperature Sensation Index——Equi–Skin Temperature Line with Inconstant Wettedness

Tohru MOCHIDA

(Received September 30, 1981)

Abstract

The characteristics of three typical equations used in calculating of evaporative heat loss from the human skin surface to the environmental air were discussed considering the total heat balance equation including the heat losses by convection, radiation and respiration. The forms of the three equations are as follows——The first is the product of quantity of perspiration and the latent heat, the second is the product of the difference between the mean humidity at the skin surface and the humidity in the ambient air and the evaporative heat transfer coefficient, and the last is the product of the difference between the saturated humidity at the skin surface and the humidity in the environmental air and both the evaporative heat transfer coefficient and wettedness. As a result, it became clear that all the lines of equal skin temperature change linearly on a psychrometric chart and the slope of the skin temperature line with equi–mean skin humidity is most gentle and that with equi–wettedness comes second and that with equi–evaporation is most steep.

From the analysis of the experimental data of subjects, a relation between wettedness and perspiration was found and a new model on the evaporative regulation was proposed. The feature of the present model is that the locus of the equi–skin temperature is a curved line on a psychrometric chart and that the wettedness on the equi–skin temperature line is not constant but takes various values.

Improvement of the Prediction Method of Local Muscle Metabolic Rate and its Application to the Determination of Metabolic Rates during Different Working Postures

Shintaro YOKOYAMA, Toshifumi NAMIOKA and Yoshifumi OGATA

(Received September 30, 1981)

Abstract

Our previous prediction method of local muscle energy metabolic rate, which consisted of simultaneous measurements of total metabolic rate and integrated surface electromyogram, was improved. The main points of improvement were the measurement procedures of the total metabolic rate, selection mode of tested exercises, a program for cleaning of data sets and a calculation program of simultaneous equations. The method was applied to determine the metabolic rates of the main seven muscle groups during different fifteen static exercises and postures. The predicted seven muscle groups were the anterior muscles of the abdominal wall, the muscle erector spinae, the muscles of the buttock, the posterior femoral muscle group, the anterior femoral muscle group, the posterior crural muscle group and the anterior crural muscle group. Seven gymnastic exercises, three standing, two half rising, one deep forward bending and two resting postures were tested in the present study. Subjects were seven Japanese normal males. As two of them failed to show metabolic rates of the anterior crural muscle group, a total of 705 metabolic rates were obtained. The present results of active five muscle groups in the static postures showed similar tendencies to our previous results. Therefore the metabolic rates in seven gymnastic exercises, which were not tested in the previous study, were discussed.

Various Types of Out-of-Plane Vibration of Arcs

Toshihiro IRIE, Gen YAMADA and Katsuaki TANAKA

(Received September 30, 1981)

Abstract

The natural frequencies and the mode shapes of out-of-plane vibrations of elastic arcs are calculated numerically on the basis of the Timoshenko beam theory and other specialized theories in which either or both of the rotatory inertia and shear deformation are not taken into account, and of the equations in which one or two of the displacements of arcs are restrained to be zero. The results are compared with one another, and the characters of out-of-plane vibrations governed by these various type equations are studied.

Generation of Field Lattice Network
Having Arbitrary Line Densities

Seiichi IIDA and Shinichiro FURUKAWA
(Received September 30, 1981)

Abstract

A method for numerical generation of a curvilinear coordinate system which has arbitrary line densities in the physical field is presented. No ristrictions are placed on the shape of the boundaries. Numerical examples are given for rhomb as a polygon and for Kármán-Trefftz airfoil as a cusped body. In the latter case, especially, the resulting curvilinear coodinate lines are orthogonal. Moreover, this method of lattice generation procedure can be readily applied to a wide variety of other problems.

A Study of Laser Machining (2nd Report)

−On the Observation with the High speed Camera Technique in the process of Micro Drilling Machining and the Characteristics of Machining in variety of Work Materials−

Toshio YUHTA and Toshikazu SATOH

(Received September 30, 1981)

Abstract

In order to clarify the mechanism of the drilling by laser machining, an experiment was carried out for a large variety of work materials by observations with a high speed camera technique.

The results are as follows. First, the relations of the depth of the drilling hole and the machining time are obtained. Next, when the focus point of the laser beam is on the inside the work material, the relation can be represented by a parabolic equation, and when the focus point is on the surface and the outter of the work material, the relation equation is the same shape but has some time delay.

Second, the relation of the maximum depth of the hole and the distance from the focus to the surface point of the work material is obtanied. This relation would depend on the characteristics of material and, generally, as it approaches the surface, it was found that the shallower the depth of the hole is the higher melting point of material is. Lastly, we can classify them into two groups, namely metal and non−metal. It was shown that the relation of the depth of the hole and the thermal conductivity is, the depth of the hole of the metal group is more affected by the thermal conductivity than the non−metal group.

ESR Imaging Spectroscopy

Keiichi OHNO

(Received September 30, 1981)

Abstract

A few coils were designed to generate magnetic field gradients for ESR Imaging and an electronic circuit was constructed for pulsation to avoid heating of coils, a cavity and its samples. The coils made of felxible print sheets were attached to the

inside wall of double quartzs cooling tube inserted in a universal cavity (TE_{011}). The coil produced a mangetic field gradient of about 100 G. cm^{-1} along the static magnetic field by a peak current of 10A. Another coil was constructed with copper wire to be attached to the external wall of a rectangular cavity (TE_{012}) in order to generate a magnetic field gradient of about 50 G. cm^{-1} along the axis of the sample hole.

Software for ESR Imaging

Keiichi OHNO
(Received September 30, 1981)

Abstract

In the measurement of ESR Imaging under moderate magnetic gradients which do not reduce SN ratios greatly, the observed spectra must be deconvoluted to become distributions of paramagnetic species. It is also necessary to use the deconvolution process for ESR Imaging on hyperfine splitted patterns. In addition, Abel inversion is necessary to obtain radial distributions regarding paramagnetic species in cylinder shaped samples. For these purposes, some programs were compiled to perform data acquisitions and deconvolution processes to evaluate their reliabilities and errors. From the results it was found that these programs were well designed and compiled for successful ESR Imaging.

Some Applications of Solid State Nuclear Track Detectors to Fast Reactor Experiments [II]
——Reactor Parameter Determinations in " YAYOI " core——

Masakuni NARITA, Hideki KON, Masatsugu AKIYAMA
(Received September 30, 1981)

Abstract

In our previous paper we discussed the characteristics of solid state nuclear track detectors for fast neutron reactor physics experiments. In the present paper the energy group neutron flux distribution in the fast reactor " YAYOI " was determined

from etched track densities.   The material buckling, the inverse diffusion length and the reflector saving were evaluated by the one- or two-group diffusion theory.   Fission track detectors are also suitable for the calibration of a low power in reactors.

I. R. Spectroscopic Study of Adsorbed Mo (CO)$_6$ on ZnO and Cataltytic Activity for Olefin Metathesis

Yushen Zhai, Ken-ichi Tanaka and Kazuo Aomura
(Received September 30, 1981)

Abstract

Adsorption of Molybdenum hexa-carbonyl on ZnO and its catalysis were studied. It was found that molybdenum carbonyl adsorbed on ZnO have no catalytic activity for the olefin metathesis reaction but an addition of a trace amount of oxygen enhances the catalytic activity for metathesis of propene.   By comparing the catalytic activity of the adsorbed carbonyls which were oxidized by oxygen and by surface hydroxide, it was concluded that oxygen is required not only for oxidation of molybdenum carbonyls but for the initiation steps of metathesis reaction.   I. R. spectra of adsorbed carbonyl no oxidiged ZnO gave an unusual absorption at 1480cm^{-1}, which may be responsible to a species being sensitive to U. V. illumination and replaceable with ambient ^{13}CO.

On Powell's Method by Means of Parallel Hyperplanes

Hideo KANEMITSU, Masaaki MIYAKOSHI and Masaru SHIMBO
(Received September 30, 1981)

Abstract

Among the methods for finding the unconstrained minimum of a function, derivative-free methods are very useful for complicated functions.   The conjugate direction methods, e.g.   Powell's method, Smith's method etc., are an example of such derivative-free methods.

In this paper, Powell's and Smith's methods are reformulated under the concept of "conjugate hyperplane", and a generalized procedure of Powell's method is proposed.

It was shown that this procedure finds the minimum of a quadratic function in a finite number of steps. Two other methods are also proposed based on this generalized procedure. Finally, a numerical comparison among Powell's and the other two methods is made by using the modified quadratic extrapolation linear search.

On the properties of two–dimensional nonassociative algebra and an application to Markus' canonical form

Tsutomu DATE
(Received September 30, 1981)

Abstract

This paper deals with an analysis of the canonical form of two–dimensional homogeneous quadratic differential equation systems, proposed by L. Markus making use of the properties of nonassociative algebra. The differential systems of this type are encountered in a number of practical problems, such as chemical reaction processes, the stability problem of critical points, and so on.

Markus' canonical form was shown to have several weak points so much so that it is necessary to make irrational calculations in order to see to which type an arbitrarily given system belongs, whereas we have only to carry out rational calculations if we use our methods.

This paper shows complete analysis of the Markus' canonical form with details of computation processes made into tables, which results in showing Markus' irrational classifications arising from the errors in his calculations.