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Appendix

Abstracts & Titles, No. 98~103

BULLETIN
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HOKKAIDO UNIVERSITY
NOTICE

No. 98 May 1980

Papers and Reports	Author	Page
1. A Study on the Estimation of Intersections for Left Turning Large Trucks	T. KAKU, K. HORIUCHI and Y. KAWAKAMI	1
2. Corrosion Inhibition of Copper with Potassium Octylhydroxamate	T. NOTOYA and T. ISHIKAWA	13
3. Effects of Forced Ignition in a Swirl Chamber Type Diesel Engine with a Glow Plug	N. MIYAMOTO, K. SASAKI, S. BOKU, N. KOHZUKI and T. MURAYAMA	21
4. An Approximate Method to Estimate the Laminar Boundary Layer Separation	H. CHINA and Y. KOBASHI	31
5. On a Parallel Computation Technique for the Monte Carlo Solutions of Partial Differential Equations	S. KOYAMA and S. DOI	41
6. A Signal Processing and Acquisition System for an Echo-Sounder Using a Microcomputer	Y. AOKI and K. IIDA	51
7. A Decimal Power Function by the Newton-Raphson Method	T. SHIBATA and M. KUGO	65
8. Statistical and Computational Data Analysis in Quasielastic Neutron Scattering	K. INOUE	77
9. Studies on the Density Stratification in Reservoirs (1) ——Process of the Thermal Stratification in a Reservoir——	M. OHTANI and I. YAKUWA	87
10. Analyses and Portraits of All Types of Divergence-Convergence Boundaries of Two-Dimensional Real Homogeneous Quadratic Transformations	T. DATE	97
11. Surface Coating of Ta Sheets for Improvement of Oxidation Resistance ——Investigation on the Pre-and Long Term-Oxidation of Calorized Ta Sheets——	K. NISHIDA and M. HACHINOHE	109

A Study on the Estimation of Intersections for Left Turning Large Trucks

Terutoshi KAKU, Kazu HORIUCHI and Yukio KAWAKAMI

(Received December 27, 1979)

Abstract

This paper deals with one of the preventive measures for traffic accidents or traffic interruptions caused by large trucks turning left at intersections.

The content and procedure are as follows.

First, the locus of a truck when it turns left at an intersection is analyzed. Second, the Characteristic Occupancy Circle (COC) as an index is calculated using the locus of the truck.

On the other hand, Occupancy Inscribed Circle (OIC), which is peculiar to each intersection and is required for left turning trucks, is calculated.

Finally, the size of COC is compared with that of OIC, and if the former is larger than the latter, we adjudge that the truck can readily execute a left turn. As a result, we can present a clear policy on the left turn prohibition for large trucks at an intersection.

In addition to above, it is possible to decide the layout and shape of corner cut at an intersection.

Corrosion Inhibition of Copper with Potassium Octylhydroxamate

Takenori NOTOYA and Tatsuo ISHIKAWA

(Received December 27, 1979)

Abstract

The inhibitive effect of potassium octylhydroxamate (P-OHO) on the corrosion of copper in both acidic and neutral NaCl solutions was investigated by means of corrosion tests, electrochemical polarization and infrared spectroscopy. P-OHO was found to be a good inhibitor in chloride environments. The inhibition efficiency was determined from weight loss measurements by using a "spinner" test assembly. The corrosion rate of copper decreased with increasing P-OHO concentration at concentrations

over 0.1 m mol/l in the neutral solutions. Corrosion tests revealed that the maximum inhibition efficiency was 98% at a concentration of 1 m mol/l in the solutions of pH 6.0~8.6. The polarization curves indicated that P-OHO was a cathodic inhibitor rather than an anodic one. Reflection-absorption infrared spectra of surface films formed on copper in the NaCl solutions in the presence of P-OHO were identified as Cu^{II}-octylhydroxamate. It was concluded that the inhibition action is mainly due to the formation of adherent films of the Cu-octylhydroxamate complex on the surface of copper and/or copper oxide.

Effects of Forced Ignition in a Swirl Chamber Type Diesel Engine with a Glow Plug

Noboru MIYAMOTO, Keisuke SASAKI, Shohtetsu BOKU
Noboru KOHZUKI and Tadashi MURAYAMA

(Received December 27, 1979)

Abstract

In this study, we attempted to improve engine performances such as specific fuel consumption, engine noise, NO_X and smoke emissions of exhaust gas simultaneously by means of a forced ignition for the fuel spray in a swirl chamber type diesel engine with the use of glow plug.

As a result of these experiments, the engine performances were found to be influenced somewhat by the location and the temperature of glow plug, and it was also found that a remarkable improvement was made by the selection of a suitable location and temperature of glow plug, compared with the absence of a glow plug operation.

An Approximate Method to Estimate the Laminar Boundary Layer Separation

Hiroshi CHINA and Yasujiro KOBASHI

(Received December 27, 1979)

Abstract

An approximate method is presented to estimate the separation point of a two-dimensional steady incompressible laminar boundary layer.

It is well known that the combination of the momentum and the energy integral equation gives a comparatively accurate solution of the laminar boundary layer.

In this paper, these equations are solved under the assumption that the shape parameters, such as displacement thickness, energy thickness which are normalized by the momentum thickness (designated by G, H) and the normalized dissipation integral Q are functions of the normalized wall shear stress P.

For the stagnation flow and the flow over a flat plate, the relations among G, H, Q and P are determined by the exact solutions. The relation among these parameters at the separation point is also determined by introducing similar solution proposed by Tani, which has one undetermined parameter. Then the quantities G, H and Q can be expressed by either quadratic or cubic functional relation with respect to P involving one variable parameter which is to be determined by examining the exact solutions of various types of flow. Iterative calculations are necessary to determine the value of the parameter, but they converge very quickly. The numerical calculation shows that the values of the parameters are very close to each other for every case, suggesting the existence of a universal similarity of the velocity profile at the separation point.

The separation points of a circular and an elliptic cylinder are calculated numerically and the results are found to be quite satisfactory.

On a Parallel Computation Technique for the Monte Carlo Solutions of Partial Differential Equations

Shoichi KOYAMA and Shun DOI

(Received December 27, 1979)

Abstract

This paper is a study of a parallel computation technique for the Monte Carlo solutions of partial differential equations using MIMD multiprocessor systems.

We deal with the case in which the number of mesh-points for a Monte Carlo solution is larger than that of the processors used there. Since, in that case, the efficiency of the processor utilization and computing time are greatly affected by the manner in allocating those mesh-points to the processors; thus we paid special attention to the problem of allocation.

In the paper we proposed a technique by which to allocate the mesh-points to the processors in an attempt to obtain a high processor utilization and thus a short computing time. Effectiveness of the proposed method is evaluated in terms of the processor utilization by numerical tests.

A Signal Processing and Acquisition System for an Echo-Sounder Using a Microcomputer

Yoshinao AOKI and Kohji IIDA

(Received December 27, 1979)

Abstract

A signal processing and acquisition system of an echo-sounder for fishing was designed. This system consists of a signal sampling unit, a signal processing unit using a microcomputer, and an electrical image display unit. It has mainly two functions, namely, the quantification by counting fish echo and by integrating echo intensity, and signal extraction of fish images by means of the image processing techniques. A trial experiment was conducted, and the availability of the system using a microcomputer was shown.

A Decimal Power Function by the Newton-Raphson Method

Toshiharu SHIBATA and Masao KUGO

(Received December 27, 1979)

Abstract

This paper is related to an algorithm for a power function; a well known Newton-Raphson iteration formula used for a n-th root is generalized to power functions of which the powers are decimal numbers.

An introduced algorithm for $x_0^{p_0}$ is constructed as a finite set of equations as,

$$x_{i+1}=(1-p_i)x_{i+1}+\frac{x_i p_i}{x_{i+2}x_{i+1}^{I_{i+1}}} \qquad i=0, 1, \ldots, k$$

$$x_{k+2}=1$$

where constants p and I are decimal and integer numbers, respectively, and can be determined from a next recurrence formula (fractionization),

$$I_{i+1}+p_{i+1}+1=1/p_i, \qquad p_{k+1}=0$$

The required functional value for $x_0^{p_0}$ is given by x_1 which converges to a constant by iterative calculations.

In the above equations, the maximum suffix k depends on figures of p_0 but can be forecasted, and the relation between these can be determined from the probability distributions under the "fractionization". Under the condition that k is large, a somewhat complicated set of equations by the revised fractionization algorithm may reduce the value of "k". Some rates of convergence of x are also illustrated numerically.

Statistical and Computational Data Analysis in Quasielastic Neutron Scattering

Kazuhiko INOUE

(Received December 27, 1979)

Abstract

The spectra of the quasielastically scattered neutrons tend to take the shapes which resemble Lorentzian distribution and reveal the characteristics concerning the fluctuating motions of atoms and molecules. The shape of the peak of the spectra can serve to determine several unknown parameters included in the neutron cross section derived from a scattering model. In this case data analysis is reduced to the problems of curve fitting and hypothesis testing.

Frequently the relation between measurable quantities and unknown parameters is non-linear, and then we are compelled to solve the minimization problem by using iterative procedure. Applying appropriate strategy we can reach the minimum, even if the first approximation of a set of unknown parameters is too far removed from true solution. The χ^2-test is also useful in the case of quasielastic scattering spectral analysis. In this paper, we present a procedure for the data analysis in quasielastic neutron scattering, and results of numerical calculations for a typical minimization problem are described.

Studies on the Density Stratification in Reservoirs (1)

——Process of the Thermal Stratification in a Reservoir——

Morimasa OHTANI and Isao YAKUWA

(Received December 27, 1979)

Abstract

Seasonal variation of the water temperature and behavior of the thermal stratification of the water in dam reservoirs are discussed in this paper, on the basis of the observational results in the Kanayama Dam Reservoir from October, 1967 to October, 1968.

The vertical distribution of the water temperature changes in the same way as the seasonal variation of the water temperature of common lakes. But at the points far from the dam, the variation is strongly influenced by the mixing with the inflow river water.

Analyses and Portraits of All Types of Divergence-Convergence Boundaries of Two-Dimensional Real Homogeneous Quadratic Transformations

Tsutomu DATE

(Received December 27, 1979)

Abstract

The aim of this paper is to analyze and illustrate in analyzing and illustrating the possible portraits of all types of divergence-convergence boundaries of two-dimensional real homogeneous quadratic transformations. The divergence-convergence boundaries can be regarded as the unit of the scale by which to measure the distance of a point from the origin in the process represented by a real homogeneous quadratic transformation.

Although the illustrations are limited to a two-dimensional case, exhaustive calculations and illustrations of their typical portraits may provide fundamental material for further analyses of such processes, which are encountered in a number of practical problems including asymptotic behaviors of the errors of the Newton-Raphson processes in numerical analysis, two-body interaction processes in biological interactions, etc.

The classification of the transformations used in this paper is based on the invariants introduced in the former papers[3,4,5].

Surface Coating of Ta Sheets for Improvement of Oxidation Resistance

——Investigation on the Pre-and Long Term-Oxidation of Calorized Ta Sheets——

Keizo NISHIDA and Mitsuo HACHINOHE

(Received December 27, 1979)

Abtsract

The present paper is to report the results for a long term oxidation at 1100°C and the improvement of the oxidation resistance of the calorized Ta sheets at 900°C and 1000°C, based on the findings obtained from the previous short term oxidation (50~55hr).

1) The oxidation behavior obtained at 1100°C for 55hr was similar to that obtained at 1200°C for 5hr.

2) After the pre-oxidization treatment of the sheet calorized at 1100°C for 1hr, the sheet

was further oxidized at 900°C and 1000°C for 50hr. As a result, the oxide formed on the sheet was maintained at about 3.3 μm thickness and there was no significant change in the oxide. The original $TaAl_3$ alloy layer was much less decomposed than that oxidized at 1100°C for 55hr and had no formation of voids. Therefore, for the protection of the calorized Ta sheets against a long term oxidation the short pre-oxidization treatment at 1100°C can be significantly effective.

NOTICE

No. 99 August 1980

Papers nd Reports	Author	Page
1. Weldability of the Composite Layer by a Double Casting Method	T. TAKAHASHI, K. OHSASA, M. ISHIKAWA and A. IMAI	1
2. Multiconductor Transmission Line Theory under an Electromagnetic Field Environment	M. KANEKO, T. HONMA and I. FUKAI	11
3. Investigasion of Minority Carrier Diffusion Length and Life Time in the Neighborhood of Grain Boundary	H. KOBAYASHI, Y. OGAWA and T. KUROBE	23
4. Notes on Laplace transformation formulas for the diffusion at the Cartesian coordinates and on some characteristics of i^n erfc (x)	T. SHIBATA and M. KUGO	35
5. Nonlinear Frequency Chirping of a Q-Switched Ruby Laser	H. FUJIWARA	49
6. Plasma Rotation in a Mirror Type Theta Pinch	Y. YASUTOMO, H. OGAWA, S. YATSU, S. HIMENO, Y. OZAWA and T. ENOTO	59
7. Studies on the Density Stratification in Reservoirs (2) —Influence of Suspended Solids and Dissolved Matters upon Density Stratification in a Reservoir—	M. OHTANI and I. YAKUWA	67
8. Desulfurization of Thiophene over HY Zeolite	M. SUGIOKA and K. AOMURA	79
9. Propagation Characteristics of Optical Beam in a Thin Glass Film Waveguide by Means of a Prism Coupler	M. KOSEKI, M. IMAI and Y. OHTSUKA	89
10. Internal Detailed Design and Transporting Process of Pascal Compiler to HITAC VOS 3 System	T. UOZUMI and E. MIYAMOTO	97
11. On the Phonetical Recognition of Mynah Mimic Vowels	M. SHIMBO, T. DATE and M. MIYAKOSHI	103

Weldability of the Composite Layer by a Double Casting Method

Tadayoshi TAKAHASHI Ken-ichi OHSASA
Minoru ISHIKAWA Akira IMAI

(Received March 31, 1980)

Abstract

We have tried a new casting method to produce an ingot composed of two layers with various compositions. We replaced the unsolidified core of the ingot with another molten alloy in the process of the ingot solidification. The weldability of the composite layer was investigated.

The change in temperature distribution in the solidification process was obtained by the finite difference method and the thermal condition on the weldability was examined in relation to the casting temperature and the composition of the composite layer.

To obtain a good weldability, it was found that the interface between the shell and the core of the ingot should be held over 5 seconds under the such conditions that fraction of solid is less than 30%.

Multiconductor Transmission Line Theory under an Electromagnetic Field Environment

Masaru KANEKO Toshihisa HONMA Ichiro FUKAI

(Received March 31, 1980)

Abstract

As the multiconductor transmission line theory under an electromagnetic field environment, the problem of coupling of external electromagnetic fields is studied for two lossless lines: homogeneous medium and cross-sectionally inhomogeneous medium cases. According to the usual mhthod telegrapher's equations with source terms are derived from Maxwell's field equations considering external fields and those produced by the line currents together. In this paper, however, the effects of external fields are replaced with the independent distributed voltage sources and ordinary telegrapher's equations are set up as basic equations. The problem is recognized from the viewpoint of primary electric circuit theory and the analysis is developed on the basis of the fundamental concept, i.e., Thevenin's theorem and law of superposition. As a consequence, it is shown that the current distribution induced on the line conductor is obtained in the same way regardless of whether the surrounding medium is homogeneous or not.

Investigasion of Minority Carrier Diffusion Length and Life Time in the Neighborhood of Grain Boundary

Hiromu KOBAYASHI Yoshihiko OGAWA Teiichi KUROBE

(Received March 31, 1980)

Abstract

A low-cost silicon sheet for terrestrial solar arrays is likely to contain structural defects such as twins and grain boundaries. These imperfections, acting as recombination centers, reduce the minority-carrier diffusion length and life time, thereby affecting the solar-cell efficiency.

Then we calculated the diffusion length and life time in the neighborhood of grain boundaries by solving the continuity equation for the minority-carrier and investigated the effect of boundaries.

The diffusion length within $1.0\,L_B$ to $1.5\,L_B$ (L_B; bulk diffusion length) of the boundary is affected, and this result approximately agrees with the experimental values. On the other hand, the life time tends to decrease almost linearly, as the distance between the two grain boundaries becomes smaller $2\,L_B$.

Notes on Laplace transformation formulas for the diffusion at the Cartesian coordinates and on some characteristics of $i^n\,\mathrm{erfc}\,(x)$

Toshiharu SHIBATA Masao KUGO

(Received March 31, 1980)

Abstract

The Laplace transformation is succesfully applied to many diffusion problems such as stratified mediums, flux alternations at the interface, etc. This paper is related to the classification and generalization of the image function such as types of $e^{-qx}/q^m/(q+h)^n$; if the transformation is defined in the usual manner as

$$L\{f(t)\} = \int_0^\infty f(t)\,e^{-pt}\,dt$$

then the image has following two original functions $f(t)$ according to m,

$$f(t) = L^{-1}\left\{e^{-qx}/q^m/(q+h)^n\right\}_{\substack{n\geq 1\\ m\geq 2}}$$

$$= (-)^m\,D\,\frac{\sqrt{4Dt}^{\,m-2}}{h^n}\,e^{-F^2}\left\{\sum_{j=0}^{m-1}\binom{m+n-j-3}{n-1}\frac{(-)^j e^j\,\mathrm{erfc}\,(F)}{(2H)^{m-j-2}}\right.$$

$$-\sum_{j=0}^{n-1}\binom{m+n-j-3}{m-2}\frac{e^j\,\mathrm{erfc}\,(F+H)}{(2H)^{m-j-2}}\Bigg\}$$

$$f(t) = L^{-1}\left\{e^{-qx}/q^m/(q+h)^n\right\}_{\substack{n\geq 1\\ m\leq 1}}$$

$$= (-)^{m+1}\,D\,\frac{\sqrt{4Dt}^{\,m-2}}{h^n}\,e^{-F^2}\sum_{j=m+n-2}^{n-1}\binom{m+n-j-3}{m-2}\frac{e^j\,\mathrm{erfc}\,(F+H)}{(2H)^{m-j-2}}$$

where $q=\sqrt{p/D}$, $F=x/\sqrt{4Dt}$, $H=h\sqrt{Dt}$, $e^j\,\mathrm{erfc}\,(x)=e^{x^2}\times i^j\,\mathrm{erfc}\,(x)$ and roundbracketed pairs are the generalized binomial coefficient. Both equations seem to closely resemble eachother, but $f(t)_{m\leq 1}$ exclude $i^j\,\mathrm{erfc}\,(F)$ because of the empty sum and the series start from different integers. The application of these equations is easy and can be dealt with as an arithmetic problem.

In the course of the analysis, some characteristics of $i^n\,\mathrm{erfc}\,(x)$ are revealed; a suggestion of the use of $e^n\,\mathrm{erfc}\,(x)$, $(=e^{x^2}\,i^n\,\mathrm{erfc}\,(x))$ in addition to an usual one, an extension of order n to negative and a correlation to Hermite's polynomial for $i^n\,\mathrm{erfc}\,(x)$, possibly a new expansion of series (eq. A-10), and a Taylor expansion of $e\,\mathrm{erfc}\,(x+y)$ and repeated integral formulas. These would be expected as new and powerful means for diffusion analyses.

Nonlinear Frequency Chirping of a Q-Switched Ruby Laser

Hirofumi FUJIWARA

(Received March 31, 1980)

Abstract

Nonlinear frequency chirping of a Q-switched ruby laser was investigated theoretically and experimentally. Differential equations governing population inversion, photon density and frequency chirping in a laser are solved for the giant pulse operation. The nonlinearity in frequency chirping arises from the time variation of the population inversion in the laser. The rate and time intervals of frequency chirping are estimated by using a method of holography of a rotating object. The holography of rotating object which we have developed will provide a powerful tool for studying frequency chirping in any pulse laser.

Plasma Rotation in a Mirror Type Theta Pinch

Yuichi YASUTOMO Hiroaki OGAWA Shigeo YATSU
Shun-ichi HIMENO Yasutomo OZAWA Takeaki ENOTO

(Received March 31, 1980)

Abstract

Plasma rotation in a mirror type theta pinch with a reverse magnetic field has been detected by magnetic probes and image-converter camera. Angular frequency of 2.5×10^6 rad/s in the direction of electron larmor gyration was observed during implosion. Experimental evidence in which the rotational motion in a theta pinch with reverse field configuration occures in a direction of electron larmor gyration has only been mentioned a few times to the present, and no physical explanation has been given. Measurement on B_θ by magnetic probe indicated that the maximum magnitude of the current flowing in the axial direction (j_z) was about 3 kA/cm. Because the magnetic field configuration was of a mirror type, a large transverse magnetic field component (B_r) normal to the plasma axis was present at the mirror throat. So, it was concluded that the plasma rotation occurring in the present type of mirror field configuration was induced by the torque due to the interaction of the axial current with the tarnsverse field. Experimental data agreed with above reported model.

Studies on the Density Stratification in Reservoirs (2)

— Influence of Suspended Solids and Dissolved Matters upon Density Stratification in a Reservoir —

Morimasa OHTANI Isao YAKUWA

(Received March 31, 1980)

Abstract

Profiles of turbidity and temperature in the Katsurazawa Dam Reservoir show several interesting features. In order to investigate the patterns of density stratification, a series of hydrological and chemical observations were carried out from October, 1969 to November, 1971. Four stations were set up in such a way that the whole reservoir area would be covered and where, once or twice a month, vertical distributions of water temperature, turbidity, suspended solids and dissolved matters were measured.

According to the observed results, density stratification was stable in every season when the influence of suspended solids and dissolved matters were considered.

Desulfurization of Thiophene over HY Zeolite

Masatoshi SUGIOKA and Kazuo AOMURA

(Received March 31, 1980)

Abstract

HY zeolite was definitely active for the cracking of thiophene at 400°C under a helium stream. The cracking products of thiophene were mainly hydrogen sulfide and trace amounts of unidentified high boiling hydrocarbon. The activity of HY in the cracking of thiophene decreased with an increase of the pulse number but the decreased activity of HY was regenerated again by treatment at 500°C in an oxygen stream. The activity change of HY by calcination agreed with that of Brönsted acidity but was independent of that of Lewis acidity. The interaction between the surface acidic hydroxyl group, i. e. Brönsted acid site of HY and thiophene molecule was observed by the infrared spectra of adsorbed thiophene on HY.

It was concluded that the Brönsted acid site of HY surface acts as the active site for the cracking of thiophene. Models of adsorption state and cracking mechanism of thiophene on HY were also proposed.

Propagation Characteristics of Optical Beam in a Thin Glass Film Waveguide by Means of a Prism Coupler

Mamoru KOSEKI Masaaki IMAI Yoshihiro OHTSUKA

(Received March 31, 1980)

Abstract

A thin glass film waveguide, which is deposited on a substrate by means of RF sputtering, is fabricated under various conditions of Ar gas pressure and sputtering time. The propagation parameters of the refractive index and the thickness of a light-guiding thin film are measured with good accuracy by coupling light from a He–Ne laser via a prism coupler. The coupling efficiency of laser light into guided modes of the glass film is determined, and the radiation loss and mode conversion, which occur due to the irregular boundaries of the waveguide surfaces and/or the refractive-index inhomogeneities in the film, are discussed in order to clarify the loss mechanisms of a thin film dielectric waveguide.

Internal Detailed Design and Transporting Process of Pascal Compiler to HITAC VOS3 System

Tetsuro UOZUMI Eiichi MIYAMOTO

(Received March 31, 1980)

Abstract

This paper describes the internal detailed design and the transporting process of the Pascal compiler which has been transported from FACOM 230–75 system to HITAC M180 system in Hokkaido University Computing Center. In the transporting process, at first, the so-called trunk compiler, in which machine-dependent parts are removed from the original compiler, is implemented, and then machine-dependent parts oriented to the target system are inserted into it. The source program of the new compiler is compiled twice in the old system. The produced object module is transported to the target system by a magnetic tape, and linked with the library routines to be an executable program.

On the Phonetical Recognition of Mynah Mimic Vowels

Masaru SHIMBO Tsutomu DATE Masaaki MIYAKOSHI

(Received March 31, 1980)

Abstract

It is justified to classify the mynah mimic vowels as well as human vowels from the standpoint of the mathematical phonetical theory proposed elsewhere, where three, and only three, effective formants are accorded to the vowel structure. In the present paper mynah's and her tutor's vowels are analyzed by a soundspectrograph to extract formant frequencies, and vowel phonemes are plotted on a projective vowel plane with axes of the logarithm of formant frequency ratios. Though the present data are restricted and few, the separation of phonemes are rather good and there can not be found a remarkable difference between mynah's and her tutor's vowel clouds.

NOTICE

No. 100 October 1980

Papers and Reports	Author	Page
1. Welding Stress Analysis by Finite Element Method	S. MAGARA	1
2. Studies on Soap Flotation of Salt-type Minerals	M. TSUNEKAWA and T. TAKAMORI	11
3. An Application of Optical Fiber Data Link to Direct Numerical Control System	T. KISHINAMI, K. SAITO, Y. UDA and S. NONAKA	21
4. An Application of Linear State Feedback to Load Frequency Control of Electric Power Systems	S. MOROZUMI, E. TANAKA, J. HASEGAWA and H. FUJIWARA	33
5. ISM Programming by Subsystemizing	T. YAMAGUCHI and I. KAJI	45
6. A Microwave Imaging System by Scanning an Absorber-Piece Controlled by a Microcomputer	Y. KITADA and Y. AOKI	51
7. Growth Conditions of High-Resistivity Semiconductor Crystals	K. KOJIMA and H. HASEGAWA	63
8. Angular and Wavelength Sensitivity of Image Reconstructed from Volume Phase Hologram	E. Y. ZHANG, Y. ISHII and K. MURATA	73
9. Desulfurization of Thiophene over CdY Zeolite and Behavior of Hydrogen Sulfide Adsorbed on CdY Surface	M. SUGIOKA and K. AOMURA	87
10. On a Stability of Clusters in the Nearest Neighbour Method	M. MIZUTA, Y. SATO, M. MIYAKOSHI and M. KAWAGUCHI	99
11. On some visual illusions as a model of Riemannian geometry	T. YAMANOI, T. KUDO, M. NARITA and M. KAWAGUCHI	107

Welding Stress Analysis by Finite Element Method

Shogo MAGARA

(Received June 30, 1980)

Abstract

The thermal elastic-plastic behavior of steel plates due to welding are expected to be affected by the temperature-dependent mechanical properties.

In this paper, the thermal stress and deformation of steel plates are analyzed by using the finite element method, in consideration to the effects of changes in modulus of elasticity and yield stress of the steel depending on temperature.

In the case of moving a heat source along a weld line, the temperature distributions of the parent plate are analyzed as an unsteady heat-conduction problem with a two-dimensional finite element method. In the analysis, a new attempt is successively derived to simulate the solidification process of deposited metal as follows; when a heat source was passed along the side of an element and reaches a node, a new element representing the increment of the deposited metal is formed which corresponds to the deformation at the processing portion.

Studies on Soap Flotation of Salt-type Minerals

Masami TSUNEKAWA and Takakatsu TAKAMORI

(Received June 30, 1980)

Abstract

The characteristics of soap flotation of salt-type minerals were studied in the present paper. The minerals used in the experiments were fluorite, barite, calcite, rhodochrosite and scheelite.

On the basis of the flotation results in natural pH, it was considered that there was a good correlation between the minimum concentration of sodium oleate required for sufficient floatability of each mineral and the critical concentration of sodium oleate required for the formation of each metal oleate in aqueous phase equilibrated with the mineral. The former concentration, however, was much lower than the latter. In the case of calcite the former was much higher than the latter, hence, in the above mentioned consideration, calcite was rejected.

In soap flotation of fluorite, when H_2SO_4 was used as a pH regulator, the floatability decreased at higher pH compared with that using HCl. And also when Na_2CO_3 was used, the floatability decreased at lower pH compared with that using KOH. Both SO_4^{--} ions

and CO_3^{--} ions affected the surface characteristics of fluorite, and adsorption of oleate on the surface was suppressed by them. Flotation characteristics of the other minerals under various pH conditions were clarified.

The action of starch as a depressant for calcite was studied. And it was confirmed that the separation of fluorite from calcite was possible by an addition of suitable amount of starch combined with that of sodium oleate.

An Application of Optical Fiber Data Link to Direct Numerical Control System

Tateshi KISHINAMI, Katsumasa SAITO, Yoshihiro UDA
and Shunsuke NONAKA

(Received June 30, 1980)

Abstract

Optical fiber communication systems were expected to be highly useful for data transmission under heavy electrical noise circumstances such as in power plants or machining factories.

As Numerical Controlled machine tools and Automatic Programming System are used increasingly in machine shops, a computer control machining system, the so-called DNC (Direct Numerical Control) system, is needed to build a higher level automatic factory.

In this paper, the Optical Fiber Data Link was tentatively applied to the data transmission between computer and Numerical Controlled machine tools. It was clearly shown that a higher reliability of data transmission in the machining factory is obtained by the Optical Fiber Data Link.

An Application of Linear State Feedback to Load Frequency Control of Electric Power Systems

Satoshi MOROZUMI, Eiichi TANAKA, Jun HASEGAWA
and Hajime FUJIWARA

(Received June 30, 1980)

Abstract

The load frequency control (LFC) of a multi-area interconnected power system is studied. The conventional controller (tie-line load bias control; TBC) has some undesirable characteristics. In order to improve on these characteristics, a new control strategy is proposed.

The oscillatory response of the TBC system, which affects the tie-line power flow and the behaviour of the LFC governing station, is one of undesirable characteristics. Recently many control strategies have been proposed to improve these characteristics. However, most of them are too complex for practical use.

The controller proposed here consists of TBC and feedback control from only three state variables (namely, an incremental frequency deviation, an incremental change in governor valve position and an incremental generation change) via gain amplifiers in each control area. To run a comparison of the proposed controller against others, simulation of the closed-loop system has been carried out not only for the step load change, but also for different types of the load change, and it was clealy shown that the controller is highly effective. Furthermore, the desirable value of the frequency bias is discussed based on stability and security of the system.

ISM Programming by Subsystemizing

Tadashi YAMAGUCHI and Ikuo KAJI

(Received June 30, 1980)

Abstract

Interpretive Structural Modeling (ISM) is a computer based technique for modeling complex systems in which structures are ill-defined or not well-known. ISM is applied to many areas, e. g. social, economic, environmental and technological systems. It has many merits and some drawbacks. One of drawbacks is the time-consuming of ISM process. To reduce this time for modeling, ISM is revised using a method we call subsystemization. In this paper, this revised ISM and the results regarding its effectiveness are described.

A Microwave Imaging System by Scanning an Absorber-Piece Controlled by a Microcomputer

Yoshitaka KITADA and Yoshinao AOKI

(Received June 30, 1980)

Abstract

A microwave imaging system was constructed by using a microcomputer and experiments with the system was conducted. The principle of the imaging technique adopted in this paper is that shadows of objects by microwave are recorded by scanning an absorber-piece in front of the objects, resulting in images of negative contrast compared with those by a conventional detector-scanned method. The signals produced by the absorber-piece are detected by a fixed receiver and converted into 8 bit digital data.

These data are stored in incore-memories of the microcomputer and stored data are displayed sequentially on a CRT scope as the absorber-piece scans the two-dimensional wave field, resulting in almost real-time imaging system. The experiment was conducted with a microwave of 9.6 GHz to record the images of metalic objects, where an electro-conductive sponge of 12 mm × 12 mm was used as a scanned absorber-piece. Numerical processings of microwave images such as averaging of images, adjusting level to produce binary images, contrast emphasis, edge extraction, etc. were conducted in this on-line microwave imaging system.

Growth Conditions of High-Resistivity Semiconductor Crystals

Kiyoaki KOJIMA and Hideki HASEGAWA

(Received June 30, 1980)

Abstract

The doping conditions to grow high-resistivity semiconductor bulks and epitaxial materials by the deep-level compensation mechanism, were investigated both theoretically and experimentally. The carrier concentrations in semiconductor materials doped with deep-level impurities are numerically solved under various doping conditions, using a three-level model involving a shallow donor level, a shallow acceptor level, and a deep impurity level.

Presence of five different regions are pointed out, and approximate expressions for carrier concentrations are derived. Then, the model is extended to a four level case, including both deep acceptor level and deep donor level.

The presence of seven regions are shown. It is pointed out that the usual procedure

of determining the energy position of deep level from the temperature dependence of resistivity or Hall coefficient, involves a rather serious difficulty.

Doping experiments are done in the liquid-phase-epitaxial growth of GaAs using iron and chromium as the dopants. High-resistivities are obtained in either doping. The behavior of the Fe-doped layer can be well characterized by the present threelevel model. On the other hand, the Cr-doped layer behaves in a complicated way, and auto-doping of deep donor is suggested on the basis of the four-levl model.

Angular and Wavelength Sensitivity of Image Reconstructed from Volume Phase Hologram

En Yao ZHANG, Yukihiro ISHII and Kazumi MURATA

(Received June 30, 1980)

Abstract

The angular and wavelength sensitivity in the reconstructed image of a volume phase hologram are studied in terms of Kirchhoff diffraction integral. The Bragg conditions are described when the thickness of dichromated gelatin hologram is increased after exposure. The angular and wavelength sensitivities of the illuminating and diffracting waves are calculated and evaluated.

Desulfurization of Thiophene over CdY Zeolite and Behavior of Hydrogen Sulfide Adsorbed on CdY Surface

By Masatoshi SUGIOKA and Kazuo AOMURA

(Received June 30, 1980)

Abstract

Cadmium ion exchanged Y zeolite (CdY) showed the activity for the cracking of thiophene at 400°C under a helium stream. The cracking products of thiophene over CdY were mainly hydrogen sulfide and trace amounts of unidentified high boiling hydrocarbon. The activity of CdY in the cracking of thiophene increased with the increase of the pulse number and attained a maximal activity at a certain pulse number and then it gradually decreased. The activity change of CdY against the pulse number corresponded with that of the amount of residual hydrogen sulfide on CdY surface, which was formed in the cracking of thiophene. The initial activity of CdY in the cracking of thiophene was considerably enhanced by the

pretreatment with hydrogen sulfide. The i. r. spectra of CdY treated with hydrogen sulfide indicated the formation of new acidic hydroxyl group, i. e, Brönsted acid sites, on CdY surface.

It was concluded that the Brönsted acid sites of CdY surface act as the active sites for the cracking of thiophene. Models of adsorption state and cracking mechanism of thiophene on CdY and the formation of new Brönsted acid sites by the pretreatment with hydrogen sulfide were also proposed.

On a Stability of Clusters in the Nearest Neighbour Method

Masahiro MIZUTA, Yoshiharu SATO, Masaaki MIYAKOSHI
and Michiaki KAWAGUCHI

(Received June 30, 1980)

Abstract

It is one of the important problems to evaluate the stability of clusters. For instance, the decision of the number of clusters is closely concerned with it. In this paper, the term stability of clusters is used in the sense that a small disturbance in the data has a small influence on the results of clustering. In the nearest neighbour method the evaluation of the stability will be characterized by the difference between two adjoining merging distances. The criteria of the stability are discussed by such a difference of the distances. And the methods of the estimation of the number of clusters are shown for the data containing statistical errors. Also these results are illustrated by some concrete examples.

On some visual illusions as a model of Riemannian geometry

Takahiro YAMANOI, Tsukasa KUDO, Masahiro NARITA
and Michiaki KAWAGUCHI

(Received June 30, 1980)

Abstract

Some visual space involving illusions are discussed from the point of Riemannian geometry. Assuming that each local visual space is furnished with paralell line fields, Riemannian metric in visual space of concentric circles and of radial lines is obtained. By

this metric tensor, the equations of geodesics are derived, and solved numerically. Further, Riemann-Christoffel curvature of the visual space is determined.

Consequently, a straight line in this visual space is considered to be one of the geodesics in Riemannian spaces.

NOTICE

No. 101 December 1980

IN COMMEMORATION OF THE TWENTIETH ANNIVERSARY OF DEPARTMENT OF ELECTRONIC ENGINEERING

Papers and Reports	Author	page
1. Acceptance Angle in Proustite Upconverters	K. KOYANAGI, T. MISHIMA and I. SAKURABA	1
2. Proposed Methods for Phase Matching in Three-Optical-Wave Parametric Processes	T. MISHIMA and I. SAKURABA	9
3. An Experiment of Standard Frequency Dissemination via a Broadcasting Satellite —— On a Precise Measurement System in Hokkaido University ——	Y. OGAWA, Y. KATOH and K. ITOH	17
4. Study on Slot Antenna and its Application in Hokkaido University	K. ITOH	29
5. Hadamard Transform Image Coding	H. KITAJIMA, T. SHIMONO and T. KUROBE	39
6. Automatic Detection of Chrominance Distortion	Y. OGAWA, H. SATO and T. KUROBE	51
7. Speaker Verification Using Time Patterns of Speech Spectrum Parameters	H. OGURA, H. HIROSE, K. TOCHINAI and K. NAGATA	61
8. Performance Evaluation of the University Computing Center System	K. TOCHINAI, H. ISHII and K. NAGATA	71
9. Barrier Height and Surface State at Metal-Silicon Contact	T. KATO and M. MAEDA	83
10. Crystallization of Amorphous Pd-Si Alloy during Low Temperature Annealing	M. MAEDA, K. MUKASA and Y. KUDO	93
11. A Few Geometrical Properties on the Traveling Salesman Problam	K. SAKAKIBARA	101
12. Finite Element Simulation of Acoustic Wave Propagation in Two-dimensional Waveguide	M. KOSHIBA and M. SUZUKI	109
13. Finite Element Analysis of Dielectric Slab Waveguide Discontinuities	M. SUZUKI and M. KOSHIBA	117

Acceptance Angle in Proustite Upconverters

Kojiro KOYANAGI, Teruhito MISHIMA and Ichiro SAKURABA

(Received June 30, 1980)

Abstract

Upconversion experiments on acceptance angle were carried out with a proustite crystal, pumped by a Nd:YAG laser (1.06 μm) and a signal from a CO_2 laser (10.6 μm) in the case of several phase-matching ways. Under tangential phase-matching conditions, all of the 10.6 μm radiation passing through an approximate circle was upconverted to 0.96 μm waves and an acceptance angle of the infrared beam of 7.0 degrees was measured for a 9.4 mm length crystal. Measured values of acceptance angle agree reasonably well with the theoretical results. It was also shown that the periodic variations of the sum-frequency output have a periodicity near 0.7 degrees ascribed to the interference effects of infrared beam in the crystal.

Proposed Methods for Phase Matching in Three-Optical-Wave Parametric Processes

Teruhito MISHIMA and Ichiro SAKURABA

(Received June 30, 1980)

Abstract

In order to reduce the angles between the ray directions and to optimize efficiency, a new phase-matching method is proposed in three-optical-wave parametric interaction using crysals. It is shown that the interaction length in this manner is longer than that in the conventional collinear phase-matching method. The relation between three wavelengths is also considered in positive and negative crystals. Calculated results for the angles between the ray directions of parametric devices using α-HgS and Ag_3AsS_3 are presented.

An Experiment of Standard Frequency Dissemination via a Broadcasting Satellite

—— On a Precise Measurement System in Hokkaido University ——

Yasutaka OGAWA, Yuji KATOH and Kiyohiko ITOH

(Received June 30, 1980)

Abstract

A color-subcarrier in a TV signal via a broadcasting satellite is expected to be an effective medium for future frequency dissemination. The difficulty inherent in use of the broadcasting satellite is a Doppler shift due to the drift around the geostationary orbit. Therefore, it is important to measure the Doppler shift of the color-subcarrier precisely and to establish a technique which cancels the effect.

This paper describes the configuration of a semi-automatic Doppler shift measurement system using the GP-IB (General Purpose Interface Bus). The system records the phase difference between a color-subcarrier and a reference signal generated from a rubidium frequency standard. The frequency of the color-subcarrier is compared precisely with that of the reference signal by measuring the phase shift versus time.

Then, this paper describes the accuracy of the rubidium frequency standard in the measurement system. Finally, it is reported that the measurement system revealed satisfactory performance.

Study on Slot Antenna and its Application in Hokkaido University

Kiyohiko ITOH

(Received June 30, 1980)

Abstract

A slot antenna is a radiating element formed by a slot in a conducting surface. Since the slot antenna was invented by Professor emeritus Asami et al. of Hokkaido University during World War II independently of other countries, many basic works have been done here in Hokkaido University. At present the slot is one of the most basic antennas in Antenna Engineering. This report introduces a state of art review on the slot antenna research and its

application in our Univesity. The slot is applicable to many practical cases in which the slot is usually backed by a shallow rectanguar cavity in order to be mounted on the surface of high speed vehicles such as a car,a rocket, and so on. Therefore, in this report, the slot backed by the shallow rectangular cavity is analyzed using the reaction matching method for obtaining the magnetic current distribution on the slot, and also the current induced method for obtaining a far field pattern. Experimental values agree well with the computed results so that our methods adopted here are reasonable and valuable.In this report,antenna systems composed of the slot antenna and wire antennas are also investigated by above-mentioned methods. These systems are applicable to maritime satellite communication and broadcasting satellite individual reception.

Hadamard Transform Image Coding

Hideo KITAJIMA , Tetsuo SHIMONO and Teiichi KUROBE

(Received June 30, 1980)

ABSTRACT

A combination of the Hadamard transform and uniform quantization is investigated. Fundamental properties of the Hadamard transform are discussed in conjunction with image coding applications ; signal energy compaction in the Hadamard domain is reviewed. As for quantization in the transform domain the rate distortion theory plays a major role in the optimum bit allocation. Uniform quantization with entropy coding is used since its performance is close to the rate distortion theoretical limit. The mean-square error measure is inherently used in transform image coding because of its mathematical tractability. The meaning of the mean-square error is discussed. A maximum-square error measure is proposed as a possible way to elude limitations imposed by the mean-square error measure. A few pictorial examples are provided.

Automatic Detection of Chrominance Distortion

Yoshihiko OGAWA Hiroshi SATO Teiichi KUROBE
(Received June 30, 1980)

Abstract

In this paper, we have discussed theoretically a new method for the detection of chrominance distortion in colour television system, and have proposed two detective systems from the theory.

Most available merit of our detective systems is that they are very low priced. Especially the analog system is lower priced than the digital one. But the behavior of the analog system may be somewhat unstable compared to the digital one. From these conclusions, we consider that the analog system may be used in colour television receivers in the future, and that the digital system may be used in the television relay stations.

Speaker Verification Using Time Patterns of Speech Spectrum Parameters

Hisayoshi OGURA, Hideharu HIROSE, Koji TOCHINAI and Kuniichi NAGATA
(Received June 30, 1980)

Abstract

Utterances of the spoken Japanese digit 4 /yoN/ were analized by linear prediction, and some statistical features of the time series of predictor coefficients α_k, PARCOR coefficients K_k and log area ratios L_k (k ; $1 \sim 10$) which represent spectrum time patterns of utterances were investigated. And speaker verification experiments have been made using these series.

Changes on spectrum parameter coefficients of utterances between utterances and ones which were uttered 1 year later, were also investigated.

Performance Evaluation of the University Computing Center System

Koji TOCHINAI, Hiroshi ISHII and Kuniichi NAGATA

(Received June 30, 1980)

Abstract

This paper describes the performance evaluation of a computer system in operation at a university computing center. In a university computing environment, there exists a wide variety of computing demands. And they increase yearly with markedly high seasonal fluctuations. Therefore, it is important to evaluate the performance of the system and employ the best operation policy.

In this study, we investigated a method for performance evaluation based on simulation technique. The method is as follows :

1) to perform bench-mark tests and obtain characteristic data of the system to be evaluat ed,

2) to build a macro model of the system using measured data, and

3) to carry out simulation under various operation conditions and workloads.

We applied this method to the FACOM230—75 computer system installed at the Hokkaido University Computing Center during 1974 to 1979. And the results indicated the general applicabillity and effectiveness of the method.

Barrier Height and Surface State at Metal-Silicon Contact.

T. KATO and M. MAEDA

(Received June 30, 1980)

Abstract

Barrier heights and their aging phenomena were studied. Especially the influence of the oxide layer was studied by means of Auger Electron Spectroscopy. The thinner the metal film is, the more pronounced aging is observed. The contact which has an oxide film thicker than about 30 Å is stable.

Crystallization of Amorphous Pd-Si Alloy during Low Temperature Annealing

M. MAEDA, K. MUKASA and Y. KUDO

(Received June 30, 1980)

Abstract

Crystallization process of Pd-Si amorphous alloy containing about 20% silicon was investigated. It was found that the crystallization initiates in the surface region at relatively low temperatures below 250°C and the atomosphere has an appreciable effect on the process. Rate of crystal growth follows the autocatalytic type of equation rather than usual Johnson-Mehr equation. The mechanism of crystallization are explained qualitatively. It was emphasized that these facts play a decisive role for the application to the electronic devices because of their large surface to volume ratio.

A Few Geometrical Properties on the Traveling Salesman Problam

Katsuaki SAKAKIBARA

(Received June 30, 1980)

Abstract

On the traveling salesman problem, the route of the example of capital cities in U. S. A. was found only by electronic computer.

In this work, two geometrical properties are found from that route.

Finite Element Simulation of Acoustic Wave Propagation in Two-dimensional Waveguide

Masanori KOSHIBA and Michio SUZUKI

(Received June 30, 1980)

Abstract

A finite element approach utilizing one-dimensional elements is presented for the analysis of the eigenmodes of a layered piezoelectric waveguide, and the conditions for real representation for the fields within each element are found. The first step is a discretization of the layered waveguide into a number of line elements, in each of which the field variables are defined by second order polynomial trial functions, and then one arrives at the matrix eigenvalue problem by using the variational principle.

Finite Element Analysis of Dielectric Slab Waveguide Discontinuities

Michio SUZUKI and Masanori KOSHIBA

(Received June 30, 1980)

Abstract

In this paper, the analytical method based on the finite element method is described for the solution of discontinuity problems in a dielectric slab waveguide. In order to minimize the details, the TE mode excitation of a symmetric slab waveguide is considered. The extension to the TM case and the asymmetric slab waveguide presents no difficulty. Numerical examples are given.

NOTICE

No. 102 January 1981

IN COMMEMORATION OF THE TWENTIETH ANNIVERSARY OF DEPARTMENT OF CHFMICAL PROCESS ENGINEERING

Papers and Reports	Author	Page
1. Measurement of Particle Motion in Acoustic Field by Laser Velocimeter Equipped with Spacial Filter	Y. NAKAJIMA, M. KUNIEDA and T. TANAKA	1
2. Characterization of Copper Kneaded with Metal oxides and Methanol Roforming Reaction	H. KOBAYASHI, N. TAKEZAWA and C. MINOCHI	13
3. Solid Mixing and Segregation in Gas Fluidized Beds of Solid Mixtures	S. CHIBA, T. CHIBA and H. KOBAYASHI	23
4. Electrochemical Reduction of Dimethyl 2, (ω−1)-Dibromoalkanedioates : A Convenient Synthesis of Cycloalkane-1, 2-dicarboxylic Acid Esters	S. SATOH, *the late* M. ITOH, H. SUGINOME and M. TOKUDA	33
5. The Cyclopolymerization in the Presence of Alkylaluminum Chlorides.	K. YOKOTA, T. KAKUCHI and Y. TAKADA	45
6. Mechano-Chemistry of Polymers (I) —— Mechano-radicals and Crystalline Structure Changes ——	J. SOHMA	55
7. Mechano-Chemistry of Polymers (II) —— Mechano-chemical reactions ——	J. SOHMA	67
8. Effect of High Salinity on the Respiration Rate of Activated Sludge	H. IMAI and K. ENDOH	79
9. Composition and Structure of Anodic Oxide Films on Copper in Neutral and Weakly Alkaline Borate Solutions	M. SEO, T. IWATA and N. SATO	93
10. Hydration of Barrier Type Anodic Oxide Films on Al in Water and Its Inhibition by Chromate	H. KONNO, S. KOBAYASHI, H. TAKAHASHI and M. NAGAYAMA	103
11. Hydrogenation Reaction of 1, 3-Butadiene by D_2 and 2-Propanol over MoS_2 Catalyst	K. TANAKA, I. YAEGASHI and K. AOMURA	113
12. Promotive Effect of Hydrogen Sulfide on the Activities of Various Solid Catalysts	T. HOSOTSUBO, M. SUGIOKA and K. AOMURA	119
13. Charge-Transfer Interaction of Benzyl Type Radical-Halide Ion Complexes	H. YOSHIDA and T. IZUMIDA	131
14. Kinetic Study on Coal Liquefaction Reaction (Part 2) —— Operation of Flow Type Reactor ——	H. MORITOMI, S. ONO, T. CHIBA and Y. SANADA	143
15. High Temperature High Resolution NMR Study of Dynamic Properies of Molten Polymer (PVC).	S. SHIMOKAWA and E. YAMADA	155

Measurement of Particle Motion in Acoustic Field by Laser Velocimeter Equipped with Spacial Filter

Yoji NAKAJIMA, Masanari KUNIEDA and Tatsuo TANAKA

(Received August 30, 1980)

Abstract

A spacial filter is located at the focal plane of a fringe-mode laser velocimeter in such a way as to detect the motion of a particle whose diameter is several times larger than the fringe size. The spacial filter was designed taking into consideration the diffraction pattern at the focal plane, and was proved to be effective for improving the visibility of a beat signal.

The motion of a particle in an acoustic field is measured by the velocimeter, and the authors' theory concerning the fluid flow around a particle in an acoustic field was checked against the data. The results show that the theory predicts the particle motion more accurately than Stokes' or Basset's equation. The applicable limits of the theory are also revealed by the data.

Characterization of Copper Kneaded with Metal oxides and Methanol Roforming Reaction

Haruo KOBAYASHI Nobutsune TAKEZAWA Chiaki MINOCHI

(Received August 30, 1980)

Abstract

Methanol reforming reaction $CH_3OH+H_2O \rightarrow CO_2+3H_2$ was carried out over copper-containing catalysts which were prepared from copper hydroxide and a variety of metal oxides by the kneading method. The catalyst prepared was characterized with the help of DTA, IR, XPS, AES, chemical analyses and the amount of surface metallic copper determind by N_2O titration. It was found that :

1) Anions in the starting material of copper hydroxide were held on the hydroxide precipitate during the course of the catalyst preparation at lower pH via ion exchange between the anion and hydroxyl group in the precipitate. The anion thus held or its fragments remaind on the surface even after calcination was carried out and inhibited greatly the reforming reaction. On the other hand, such an anionic group was thermodynamically unfavorable to be exchanged with the hydroxyl group at higher pH. The catalyst prepared at higer pH was, therefore,

highly active for the reforming reaction.

2) Cation of the precipitant such as Na^+ or K^+ was not incorporated in the precipitate, so that it exerted no influence upon the reaction.

3) The surface area of metallic copper greately increased when copper was kneaded with silica. This resulted in the increase in the specific catalytic activity (activity alloted for the weight of copper used).

4) Turnover frequency, selectivity and the actvation energy of the reaction were held constant irrespective of the catalyst preparation.

5) Support employed produced no chemical effect upon the reaction under the present experimental conditions.

6) On the basis of the above, a highly active and selective catalyst was prepared in the present experiment.

Solid Mixing and Segregation in Gas Fluidized Beds of Solid Mixtures

S. CHIBA T. CHIBA H. KOBAYASHI

(Received August 30, 1980)

Abstract

In order to elucidate the effects of particle properties and operating conditions upon the minimum fluidization velocity and mixing-segregation phenomena in the fluidized bed of binary particle systems, the pressure drop across the bed, mean voidage in the bed and axial distributions of jetsam concentration were measured in the bed with various combinations of different particles under various gas velocities and mean compositions of particles. Apparent minimum fluidization velocity u_{mf} of the bed of binary particle systems which tends to segregate was defined relevant to the extent of segregation in the bed. It was demonstrated that the values of the apparent u_{mf} are dependent upon the mode of gas velocity change prior to the measurements. It was also shown that the operating conditions such as gas velocity, bed height, average concentration ratio of particles in binary systems are important parameters which affect the extent of the segregation of particles which is due to the difference in size and density. A concept of segregation map which facilitates the mixing state of particle systems was proposed.

Electrochemical Reduction of Dimethyl 2, (ω−1) -Dibromoalkanedioates : A Convenient Synthesis of Cycloalkane-1, 2-dicarboxylic Acid Esters

Shohei SATOH, *the late* Mitsuomi ITOH, Hiroshi SUGINOME* and Masao TOKUDA

(Received August 30, 1980)

Abstract

Constant current electrolyses of dimethyl 2, (ω-1) -dibromoalkanedioates **(1)** in tetrahydrofuran containing tetrabutylammonium perchlorate as a supporting electrolyte using a platinum cathode afforded the corresponding *trans* and *cis* dimethyl cycloalkane-1, 2-dicarboxylates **(2)** in moderate to good yields. Three to seven-membered ring cycloalkanes **(2)** can be prepared by this electrolysis. The solvent, cathode material and electrolysis potential were found to affect appreciably the ratios of the *trans* and *cis* isomers. The electrolysis of dimethyl 2, 4-dibromopentanedioate **(1a)** using a mercury pool as a cathode gave the corresponding cycloalkane **2a** in a lower yield and the product was accompanied by a large amount of open-chain esters. The present electrolysis probably proceeds *via* a two electron reduction of one of the carbon-bromine bonds of dibromoalkanedioates **(1)** to generate a carbanion which then undergoes an intramolecular nucleophilic attack on a carbon bearing bromine atom.

The Cyclopolymerization in the Presence of Alkylaluminum Chlorides.

Kazuaki YOKOTA, Toyoji KAKUCHI, and Yoshiyuki TAKADA

(Received August 30, 1980)

Abstract

The extent of cyclization and the rate in cyclopolymerization of nonconjugated dienes having both electron-rich and electron-deficient double bonds such as *o*-allylphenyl acrylate, 2-(*o*-allylphenoxy)ethyl acrylate, and 4-(*o*-allylphenoxy)butyl acrylate were found to increase by the addition of alkylaluminum chlorides. It was found that highly cyclized polymers containing eight-, eleven-, and thirteen-membered ring are obtained by this method.

The addition of alkylalminum chlorides was less effective, however, for an increase of the extent of cyclization in the cyclopolymerization of 6-(*o*-allylphenoxy)hexyl acrylate, which gave polymers containing fifteen-membered ring. Hardly any effect was found by an addition of alkylaluminum chlorides in the cyclopolymerization of 10-(*o*-allylphenoxy)decyl acrylate to form

nineteen-membered ring. The addition of alkylalminum chloride in the cyclopolymerization of monomers having oligooxyethylene chain was found to be particularly effective for increasing the extent of cyclization and the rate ; an appreciable effect was observed even in the cyclopolymerization which involved the formation of seventeen-membered ring.

The results of the experiments including cyclocopolymerization of dienes with p-chlorostyrene suggested that this cyclopolymerization in the presence of alkylaluminum chlorides may proceed *via* a mechanism similar to alternating copolymerization.

Mechano-Chemistry of Polymers(I)
—— Mechano-radicals and Crystalline Structure Changes ——

J. SOHMA

(Received August 30, 1980)

Abstract

Based mainly on results obtained in our laboratory recent developments of mechano chemistry of polymers are surveyed. The definition of the mechano-chemistry as well as the differences among chemo-mechanical system and chemorheology are mentioned. Mechano-radicals were defined as free radicals produced by mechanical actions and several examples of mechano-radicals are cited. It was found that there is a critical degree of polymerization for the production of mechano-radicals. Conditions, in which mechano-radicals are identified as primary products by mechanical excitation, are discussed. Among the mechano-radicals observed from various polymers only polypropylene mechano-radicals alone satisfied the conditions and were identified as primary products of the main-chain scissions induced by mechanical actions. Several molecular models, including our own, for fractures of solid polymers are critically compared. It was discovered by comparing X-rays profiles before and after the fracture that crystalline transformations of both polyethylene and polypropylene were induced by long-time ball-milling. These transformations were reversibly recovered by heat-treatment at temperatures below the melting temperatures of crystals. Both degrees of crystallinity and size of crystallites were reduced after the milling and these reductions were irreversible even after heat treatment. It was concluded from ESR studies that polypropylene mechano-radicals were produced and trapped on the fresh surfaces which were generated by the fractures simultaneously.

Mechano-Chemistry of Polymers (II)
—— Mechano-chemical reactions ——

J. SOHMA

(Received August 30, 1980)

Abstract

Mechano-chemical reactions related to polymers, which were discovered in our laboratory, were studied. It was found that excess charges produced by triboelectricity during the milling, play an important role in the anomalous decay of polypropylene (PP) mechano- radical and a mechanism for this anomalous behavior in the decay process was proposed. Conversion of the polymethylmethacrylate (PMMA) mechano-radicals was induced by the milling of the PMMA solid containing the mechano-radicals. No conversion of this type was induced by heat- treatment. Thus, it can be said that conversion of PMMA mechano-radicals was specifically caused by mechanical agitation. Conversions of polyethylene mechano-radicals were also found by long- time milling of PE solid containing the mechano-radicals. The same conversions were found for the PE mechano-radicals by heat-treatment at temperatures above 110°K. No mechano-chemical conversion was observed for PP mechano-radicals, which require higher temperatures exceeding 213K for thermel conversion. When these mechano-chemical conversions were compared with thermal ones, the temperatures at the sites which trap mechano-radicals were estimated to be between 110K to 213K when the bulk temperture of the sample was kept at 77K. Four possible mechanism i. e., a direct process of mechanical agitation, local heating due to friction, the effect of fresh surfaces produced by fractures, and the effect of triboelectricity, were discussed.

Effect of High Salinity on the Respiration Rate of Activated Sludge

Hiroshi IMAI, Kazuo ENDOH

(Received August 30, 1980)

Abstract

Oxygen uptake rate measurements were performed on activated sludges acclimated to glucose and Polypepton (sludge no. 1), and n-dodecane and Polypepton (sludge no. 2) cultivated in fresh-water medium and subjected to shock loads of three types of synthetic sea water which had a wide range of salinity.

On addition of saline water, the specific growth rate in glucose medium increased with chloride ion Cl^- concentration C up to 4 g/l, then decreased in accordance with the following equation, showing a similar relationship to that of non-competitive inhibition :

$$\mu/\mu_0 = 15.53/\ \{15.53+(C-4.85)\},\ C \geqq 2.7\ \text{g}/l$$

where μ_0 is the specific growth rate in fresh-water medium.

The endogenous respiration rate of no. 1 sludge was decreased by an addition of saline water in the range of C=3.36−33.8 g/l. At $C \geqq 14$ g/l, the endogenous respiration rate was 45% of that of fresh-water sludge.

For oil acclimated no. 2 sludge, the endogenous respiration rate was scattered around that of fresh-water sludge at $C \leqq 10$ g/l. At $C > 10$ g/l, the endogenous oxygen uptake rate was equal to or less than that of fresh-water sludge.

Respiratory activity in the glucose or n-C_{12} medium was mostly increased in the range of $C \leqq 4$ g/l, and was decreased at higer concentrations of Cl^-. The relation between the relative activity and salinlty (C) could be expressed by the following equation, which has the form of that for non-competitive inhibition :

$$R/R_0 = 26.4/\ \{26.4+(C-4.04)\},\ C \geqq 0.95\ \text{g}/l$$

where R is the total oxygen uptake rate minus the endogenous respiration rate, and suffix o idicates fresh-water medium.

Respiratory activity during acclimation of sludge no. 1 to a synthetic sea water was also examined experimentally for two modes of salinity elevation. A faster salinity rise took 13 days to reach that of 100% synthetic sea water and the slower one required 23 days.

Respiratory activity in glucose medium increased transiently then decreased during the salinity rise. The faster salinity rise depressed the activity more rapidly than the slower one. Within the same salinity in the range of 9−19 g-Cl^-/l, the respiratory activity of the sludge in which the salinity was increased more rapidly or in a shorter period was higher than that of the sludge in which the salinity was increased over a longer period. When salinity reached that of 100% synthetic sea water, the respiratory activities of the two types of sludge were 30−50% of that of the fresh-water sludge. Thereafter, the activities increased gradually, taking 62 days or more to reach that of the fresh-water sludge.

Composition and Structure of Anodic Oxide Films on Copper in Neutral and Weakly Alkaline Borate Solutions

Masahiro SEO , Tomoo IWATA and Norio SATO

(Received August 30, 1980)

Abstract

Copper surfaces anodically oxidized at constant potential for 1h in deaerated neutral and weakly alkaline borate solutions were examined by using electrochemical techniques combined with Auger electron spectroscopy (AES) and X ray-photo electron spectroscopy (XPS). The thickness (1～4 nm) of anodic oxide films coulometrically estimated decreased with increasing anodic potential in the active region but increased in the passive region, irrespective of the solution pH. The anodic oxide films formed on copper in the passive region consisted of Cu_2O as an inner layer and of partly hydrated cupric oxide, $CuO_x(OH)_{2-2x}$ as an outer layer. Dehydration of the outer layer progressed with the increasing anodic potential. The active potential region of copper was divided into two parts ; Cu_2O film was directly formed on copper without any dissolution of cuprous ions in active region 1 whereas in active region 2 the formation of Cu_2O and the dissolution of cupric ions proceeded simultaneously.

Discussion was made on the formation mechanism of the outer layer in the passive region and on the dissolution mechanism of Cu_2O in the active region.

Hydration of Barrier Type Anodic Oxide Films on Al in Water and Its Inhibition by Chromate

Hidetaka KONNO, Shiro KOBAYASHI
Hideaki TAKAHASHI and Masaichi NAGAYAMA

(Received August 30, 1980)

Abstract

Compact oxide films were formed on Al in a neutral borate solution (pH 7.4, 20°C) by applying a constant potential of 50 V (vs. SCE), and then they were immersed in twice distilled water or a 0.001 mol/dm^3 chromate solution (pH 7.0). The composition changes in the oxide films before and after immersion were examined by X-ray photoelectron spectroscopy (XPS) and chemical analysis, combined with chemical sectioning of the films in a sulfuric acid so-

lution. After a 3 day immersion in distilled water the outer part of the film contained a three fold number of OH^- ions as before immersion, and the film retained only 30 V instead of 50 V. The concentration profile of electrolyte anion (BO_2^-) in the film remained unchanged, showing that the deterioration of the film is not due to dissolution and reprecipitation but is caused by hydration of the oxide. It was found that the hydration is strongly inhibited by the presence of chromate. XPS and chemical analysis showed that CrO_4^{2-} ions are adsorbed on the oxide surface to form a monolayer, thus hindering the penetration of water molecules into the oxide layer.

Hydrogenation Reaction of 1,3-Butadiene by D_2 and 2-Propanol over MoS_2 Catalyst

Kenichi TANAKA , Isamu YAEGASHI and Kazuo AOMURA

(Received August 30, 1980)

Abstract

Hydrogenation of 1, 3-butadiene was performed with a mixture of deuterium and 2-propanol over MoS_2 catalyst at 140°C, which yielded 1-butene and 2-butene containing deuterium atoms of zero (d_0), two (d_2), three (d_3) and four (d_4).

Few d_1-butene formation indicates independent operation of the respective hydrogenation reactions on MoS_2 catalyst. The fact that few butenes containing more than five deuterium atoms suggests multi-exchange with deuterium via sec- butenyl intermediates.

It was concluded that the reaction of 1, 3-butadiene with D_2 as well as the hydrogen transfer from 2-propanol to 1, 3-butadiene may proceed via sec-butenyl intermediates on sites having three degrees of coordinative unsaturation, on which mutual exchange between D_2 and 2-propanol can not take place during the reaction.

Promotive Effect of Hydrogen Sulfide on the Activities of Various Solid Catalysts

Tomiji HOSOTSUBO, Masatoshi SUGIOKA
and Kazuo AOMURA

(Received August 30, 1980)

Abstract

For acid catalyzed reactions, the catalytic activities of metal ion exchanged Y zeolites (MeY, Me=Cd^{2+}, Cu^{2+}, Ni^{2+}, Co^{2+}, Ag^{+} and Zn^{2+}), and metal ion supported on silica-alumina, silica gel and alumina (Me-SiO_2-Al_2O_3, Me-SiO_2 and Me-Al_2O_3, Me=Ag^{+}, Cu^{2+}, Cd^{2+}, Co^{2+} and Ni^{2+}) were enchanced by the treatment with H_2S.

From the infrared spectroscopic study, it was concluded that an increase in catalytic activity of catalysts by H_2S treatment was attributed to the formation of new Brönsted acid sites on the catalyst surface. These catalysts contained metal ions which bind strongly to H_2S. Thus, it was concluded that an increase in catalytic activity was strongly dependent on the affinity of metal ions in catalysts toward H_2S.

Charge-Transfer Interaction of Benzyl Type Radical-Halide Ion Complexes

Hiroshi YOSHIDA and Tatsuo IZUMIDA

(Received August 30, 1980)

Abstract

When a benzyl type radical is generated by the dissociative electron attachment to a halide compound in γ-irradiated organic rigid matrices at low temperature, the radical becomes complexed temporarily with the counter halide ion. The radical-ion interaction has been studied in detail by means of the fluorescence spectroscopic method. The results of the study are auto-reviewed. The most significant finding is that the radical-ion complexes generally show charge-transfer bands, whose transition enegy follows the relationship,

$$h\nu_{CT}=E_A(X)+E_S(X^-)-\{E_A(R\cdot)+E_S(R^-)\},$$

where E_A and E_S refer to electron affinity and solvation energy, and X^- and $R\cdot$ to the halide ion and the radical. Based on the relationshop, the electron affinities of methyl-substituted benzyl radicals were successfully determined.

Kinetic Study on Coal Liquefaction Reaction (Part 2)
—— Operation of Flow Type Reactor ——

Hiroshi MORITOMI Shigeyoshi ONO
Tadatoshi CHIBA Yuzo SANADA

(Received August 30, 1980)

Abstract

For coal liquefaction reaction, there are many drawbacks in the batch reactor to obtain the desired data.

In contrast, the flow type reactor has many advantages to obtain the desirable data. A test model unit of flow micro reactor was built and operated. The test unit (M-II) was rearranged with the reactor tube and vessels of Coal Hydrogenation Micro Reactor Test Unit M-I. The flow diagram of the M-II is depicted in Fig. 2.

Characteristics and flow properties of coal/petroleum light oil and coal/anthracene oil slurries under high pressure were discussed. In order to obtain the steady flow condition, viscosity of vehicle oil is one of the most important factors. Conversion of liquefaction was also discussed.

High Temperature High Resolution NMR Study of Dynamic Properties of Molten Polymer (PVC).

Shigezo SHIMOKAWA and Eiji YAMADA

(Received August 30, 1980)

Abstract

The dynamic structure of molten polymer in the process of pyrolysis of PVC (Polyvinyl chloride) has been studied from the line shape and spin-lattice relaxation time using a homogeneous magnetic field in a temperature range from 100°C to 500°C. Well resolved spectra were observed for thermally decomposed molten PVC. The aromatization process has been measured directly from the change of intensity of the aliphatic and aromatic protons. It was found that the use of high resolution nmr at high temperatures provides very useful information on the decomposition process of polymers.

NOTICE

No. 103 February 1981

Papers and Reports	Author	Page
1. Selective Flotation of Fluorite from Calcite with Sodium Dodecylsulfate	M. TSUNEKAWA and T. TAKAMORI	1
2. Studies on conductivities of sandbeds in sandbed mappers	Y. TANAKA, N. YOSHIDA and J. FUKUOKA	9
3. Heat of Formation of Saturated Hydrocarbons and Topological Index	H. NARUMI, H. HOSOYA and M. KATAYAMA	19
4. Some Applications of Solid State Nuclear Track Detectors to Fast Reactor Physics Experiments [I] —Neutron Sensitivities and Fission Rate Measurements in YAYOI Core—	M. NARITA, F. FUJITA, K. WADA and M. AKIYAMA	27
5. Studies on the Density Stratification in Reservoirs (3) —Vertical Distribution of Grain Size of Suspended Solids and Its Seasonal Change—	M. OHTANI and I. YAKUWA	41
6. Desulfurization of Thiophene over Metal Ion Exchanged Y Zeolites	M. SUGIOKA and K. AOMURA	53
7. Research on Driving Aptitude and Extension of Effective Counselling	F. MORI	61

Selective Flotation of Fluorite from Calcite with Sodium Dodecylsulfate

Masami TSUNEKAWA and Takakatsu TAKAMORI

(Received September 30, 1980)

Abstract

A new flotation method for the separation of fluorite from a fluorite-calcite mixture was proposed in the present paper. Sodium dodecylsulfate (SDS) as collector and metylisobutylcarbinol (MIBC) as frother were used in the experiments.

In the previous paper, the authors reported that adsorption of SDS on calcite was mainly electrostatic, on the other hand adsorption of SDS on fluorite was due to both chemical adsorption forming surface calcium dodecylsulfate and electrostatic adsorption. And also the characteristics of solubility of calcite in acid solution were clarified.

On the basis of the our experimental results mentioned above, an Adsorption-Washing-Flotation Method was developed by the authors. Fluorite-calcite mixture was conditioned with a SDS solution at a concentration of 29 mg/*l* and a desired pH, subsequently washed with a solution of the same pH. After which, flotation was carried out at the same pH with only an addition of the frother. The results obtained showed that fluorite was sharply separated from calcite by lowering the pH below 2.2. The tailing produced in the first treatment was treated again in the same way. The cumulative recovery of fluorite obtained by the treatments of two stages was 94% and acid-grade fluorite concentrates were produced as froth products.

Studies on conductivities of sandbeds in sandbed mappers

Yasuhiro TANAKA, Norinobu YOSHIDA, Jun-ichi FUKUOKA

(Received September 30, 1980)

Abstract

In order to analyse flow patterns in a sandbed mapper, a visual analog with Poissonian fields, conduction factors and hence conductivities of sandbeds were measured. Conduction factors of sandbeds made of small copper particles were well expressed by Reynolds number Re/2000 in a range of $6.49\times10^{-3}\sim2.29$ of Re.

Heat of Formation of Saturated Hydrocarbons and Topological Index

Hideyuki NARUMI, Haruo HOSOYA and Meiseki KATAYAMA

(Received September 30, 1980)

Abstract

A linear relationship of the heat of formation of linear and branched saturated hydrocarbons with the topological index Z was found and discussed.

Some Applications of Solid State Nuclear Track Detectors to Fast Reactor Physics Experiments [I]

— Neutron Sensitivities and Fission Rate Measurements in YAYOI Core —

Masakuni NARITA, Fumiyuki FUJITA, Kenichi WADA, and Masatsugu AKIYAMA

(Received September 30, 1980)

Abstract

Solid state nuclear track detectors have been applied to measurements of some reactor parameters in the fast neutron source reactor "YAYOI".

In this paper the neutron energy dependent absolute sensitivities of recoil track detectors as well as fission track detectors are determined and the measurement of absolute fission rates and fission ratios are discussed. The main disadvantage of the technique for application of reactor physics experiments has been in counting tracks by the naked eye. This has been overcome by counting tracks with the Luzex 450 counter which is an automatic counting device.

It has been shown that the application of the detectors to fast reactor experiments are more useful than the measurement of activation foils in some respects of high sensitivity, direct fission density measurement, high spatial resolution and n-γ separation.

In the next paper we will discuss the fast neutron flux determination and other reactor parameters.

Studies on the Density Stratification in Reservoirs (3)

—— Vertical Distribution of Grain Size of Suspended Solids and Its Seasonal Change ——

Morimasa OHTANI and Isao YAKUWA

(Received September 30, 1980)

Abstract

This paper treats the vertical distribution of suspended solids of various size and their seasonal change in reservoir waters.

In order to grasp the characters of these phenomena, observing the concentration of turbidity was undertaken and the water temperature was measured at a point 50–100 m from the dam at the Katsurazawa Dam Reservoir from May 1978 to April 1978.

The results of the observation show that in the stagnant period of summer the mean particle size becomes smaller as the water increases in depth and in other seasons the distribution curves are found to be irregular.

The vertical distribution of suspended solids in reservoir waters appears to be closely related to the inflow and outflow.

Desulfurization of Thiophene over Metal Ion Exchanged Y Zeolites

Masatoshi SUGIOKA and Kazuo AOMURA

(Received September 30, 1980)

Abstract

The activities of various kinds of metal ion-exchanged Y zeolites (MeY) for the desulfurization of thiophene were examined at 400°C under a helium stream by use of the pulse reactor. Some kinds of MeY (Me=Ni, Co, Cu, Ag, Zn, Mg, Cd, Ca) showed activity for the desulfurization of thiophene and the order of the activity of MeY at 400°C was as follows:

$$CuY, AgY > ZnY > NiY, CoY > CaY > MgY > CdY > NaY, BaY, PbY \approx 0$$

This order of activity is almost in parallel with that of the activity in the dealkylation of cumene at 400°C except for CuY, AgY and a linear relationship through the origin was observed between the apparent first order rate constants in the dealkylation of cumene and the conversion of thiophene. The initial activity of MeY at the first pulse for the

desulfurization of thiophene were enhanced by the pretreatment with hydrogen sulfide.

From these results, it was concluded that the active sites of MeY for the desulfurization of thiophene are the Brönsted acid sites of MeY surface. A model of the desulfurization mechanism of thiophene over MeY were also proposed.

Research on Driving Aptitude and Extension of Effective Counselling

Fumio MORI

(Received September 30, 1980)

Abstract

Psychological problems of drivers are gradaually increasing in importance for safety in road transport systems. The aim of this paper is to make some observations to obtain assurance of road-traffic safety and accident prevention. The following is the gist of the article: The following is a rough outline of the article.

1. On the aptitude test for the persons to be employed as new drivers and also for drivers who have already been working and have become involved in traffic accidents.
2. On counselling service for drivers.
3. On "Safety First Education" and the periodic training for the administrators of auto transport business and also for would-be administrators.

It is assumed that a considerable improvement and modern devices in the future, will have a bearing on the improvement on the entry in the assesment sheet after the test is given and also in comments will be made, but it is recognized that the present system has shown its effectiveness.