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Appendix

Abstracts & Titles, No. 149~152

BULLETIN

OF THE

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HOKKAIDO UNIVERSITY

NOTICE

No. 149 February 1990

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Formulas for Determination of Fundamental Periods of Cylindrical Shells in Contact with Liquid

Takashi MIKAMI and Jin YOSHIMURA
(Received September 30, 1989)

Abstract

The fundamental period of a cylindrical shell in contact with liquid is probably the first item of interest in the dynamic analysis. This paper presents simple practical formulas for estimating the fundamental periods of the cantilever shells in beam-type (n=1) motion. The formulas are obtained by using Dunkerley's approximation in combination with the collocation method developed in the authrs' past work and by considering both the shell mass and the liquid mass. The formulas are applicable to the following types of shells: (1) the liquid is contained within the shell; (2) the shell is submerged in the liquid; and (3) both sides of the shell are in contact with the liquid. A comparison with other solutions suggests that the proposed foumulas provide satisfactory accuracy for a wide range of shells. In addition, the formulas presented are useful not only for a better understanding of the vibration characteristics of the shell but also available for a check on ther numerical methods.

The Influence of Grain Shape and Grain Size Distribution on the Mechanical Properties of Sands.

Kinya MIURA, Keiju HASEGAWA,
Yoshihide MATSUMOTO and Shousuke TOKI
(Received September 30, 1989)

Abstract

Deformation-failure behavior of sand varies considerably, depending on their primary properties, such as grain shape, crushability and grain size distribution. To reveal the significance of primary properties in sand deformation-strength characteristics is the aim of present study. The preceding companion report dealt with the effects of primary properties on physical properties, and present report deals with the effects on mechanical properties.

Some 80 sand samples with different grain shapes and grain size distributions were

prepared from three different kinds of sands. Drained triaxial compression tests were performed on all the sand samples with the same relative density; the observed deformation behaviors showed a remarkable influence of primary properties on deformation-failure behaviors.

Deformation behaviors during consolidation and shearing, and failure behaviors were examined. The conclusion is summarized as follows.

1) Clear correlation is found among compressibility during consolidation, shear rigidity and dilatancy contractivity during shear. The sand that consists of more angular particles has a higher void ratio and is more compressive, less rigid and more contractive.

2) Shear strength is influenced by grain shape, crushability and grain size distribution, the more angular, less crushable and better graded sand exhibits higher shear strength.

3) It is not true for the sands with different primary properties that the sand with higher shear rigidity exhibit higher shear strength, which is believed generally true for a particular sand with different densities and different confining pressure.

Frictional Properties Between Geogrids and Soils Observed by Direct Shear Test

Toshiyuki MITACHI and Hiroshi KASHIWAKURA

(Received Sepoember 30, 1989)

Abstract

In order to design the embankment when the geogrid is used within the soil mass as a reinforcement material, appropriate evaluation of mechanical interaction between the banking material and the geogrid is very important.

In this paper, the evaluation of frictional properties between the geogrids and sand or clay is given by performing a series of direct shear tests.

Experimental results show that there exists two key factors influencing the frictional properties, the thickness and the opening size of the geogrid. Suitable combination of these two factors can increase the frictional resistance between the geogrid and soil mass.

The Influence of Stress Release due to Sampling on the Undrained Strength of Anisotropically Consolidated Clay

Toshiyuki MITACHI, Yutaka KUDOH
Hiroya UMEKI and Yoshinori TANIGUCHI
(Received September 30, 1989)

Abstract

In general, the shear strength of cohesive soils is greatly influenced by the stress change to which they have been subjected before shear. Even if perfectly "undisturbed" samples could be obtained without mechanical disturbances owing to the improvement of sampling technique, they would inevitably be subjected to a change in stress condition on removal from the ground, and the strength obtained might be more or less affected by this change. The importance of the evaluation of this effect on the stress-strain-strength behaviour of clays have been discussed for a long time. But the studies extracting the influence of stress release on the unconfined compressive strength and the magnitude of back pressure on the consolidated undrained triaxial compressive strength are extremely limited.

The purpose of the present study is to investigate the influence of effective stress change on the strength properties of normally consolidated clays by the tests simulating the process from the in situ stress condition to the unconfined compression and triaxial compression test condition.

Six series of test were conducted on a saturated remolded clay to simulate the shear failure of soil mass in situ under undrained condition and to simulate routine unconfined compression test, together with unconsolidated undrained and consolidated undrained triaxial compression tests.

Experimental results indicate that

1) strength decrease due to the influence of stress release only is 6 to 7%, 2) strength decrease in the routine unconfined compression and unconsolidated undrained compression test without the influence of swelling is about 20%, 3) routine consolidated undrained test overestimates the rate of strength increase due to consolidation up to 35%, and 4) undrained shear strength almost equals to that of in situ which can be obtained by approximating the effective stress condition in situ.

Analysis of Fraction Solid During Crystallization of Statically Undercooled Molten Steel

Yang GAO, Masayuki KUDOH, Ken-ichi OHSASA
and Tadayoshi TAKAHASHI
(Received September 29, 1989)

Abstract

The fraction solid during solidification of statically undercooled molten Fe-C binary alloys and carbon steel were calculated using a heat balance equation.

The mother alloy of the specimen were made by REM addition to enhance the undercooling. The sample of 12g in weight which was taken from the mother alloy was cooled from 1580℃ with 0.18℃/s, and temperatures of the specimen and atmosphere were measured. As a result, the maximum degree of the undercooling up to 284℃ was obtained. In the stage of low undercooling two transformation points were recognized in the cooling curve of the specimen and in high undercooling only one transformation point was recognized. The results obtained showed that, when the degree of undercooling of molten alloys increased, the fraction solid in the maximum recalescence point during crystallization reached 1.0 and the heat of fusion was reduced to 2/3 at the maximum degree of undercooling of 284℃ compared with one of pure Fe and solidification time of alloys was also decreased.

Change in Density During Undercooling and Solidification of Carbon Steel

Yang GAO, Masayuki KUDOH, Ken-ichi OHSASA
and Tadayoshi TAKAHASHI
(Received September 28, 1989)

Abstract

The change in density of molten S25C carbon steel from liquid state to solidification with undercooling up to 120℃ was estimated by measuring shrinkage at the top of molten steel with a crucible of a special shape. The fraction solid was calculated by using the obtained densities and compared with fraction solid calculated by the heat transfer method. The results showed that the relation between the density of molten carbon steel and the temperature from 1382 to 1565℃ was expressed as follows:

$\rho(g \cdot cm^{-3}) = 7.977 - 5.263 \times 10^{-4} T(K)$

The value of fraction solid obtained from the density method was in agreement with that of the heat transfer method. However it agreed only in the stage of small fraction solid because of crystallization of large undercooling.

The Effect of Methanol Vehicles' Exhaust Gases on the Photochemical Oxidants — Using a One-Box Model —

Tazuko MORIKAWA and Kenichi ITO
(Received September 30, 1989)

Abstract

The introduction of methanol fueled vehicles may increase methanol and the formaldehyde concentration in the atmosphere. Especially because formaldehyde is a highly reactive species, it can promote photochemical oxidants. Thus we evaluated the effect of methanol vehicle exhaust gases on photochemical oxidants by a One-Box model.

If all diesel buses running in the Tokyo metropolitan area were converted into methanol fueled vehicles, there would be little difference in ozone formation. But if all the diesel buses and diesel trucks were converted into methanol fueled vehicles, the effect of a reduction of NO_X would lead to a reduction of ozone formation.

Steady-State Response of a Damped Cantilever Annular Sector Plate with Curved Radial Edges

Katsuaki TANAKA, Gen YAMADA and Yukinori KOBAYASHI
(Received September 30, 1989)

Abstract

The steady-state response is presented for a damped cantilever annular sector plate with curved radial edges by the Ritz method. The plate is transformed into a regular sector plate with unit outer radius by a transformation of variables. The transverse displacement of the transformed plate is approximately expressed in series of the power function. Substituting the expression for the kinetic and strain energies of the plate into

Lagrange equation, the dynamic response of the plate is derived analytically. The numerical examples are calculated for annular sector plates with symmetrically curved radial edges. The effects of the damping factor and observation point are studied on the steady state responses of the plate.

An Analytical Study of Freezing Characteristics of an Aqueous Binary Solution on Upper Facing Cooled Plate

Shoichiro FUKUSAKO and Masahiko YAMADA
(Received September 30, 1989)

Abstract

An analytical study has been performed to investigate the freezing characteristics of an aqueous binary solution on an upper facing cooled plate. In the analysis, the effect of concentration diffusion was assumed to be neglected, and furthermore, one dimensional conduction heat transfer with thermal equilibrium was assumed. The Landau's transformation method and five point implicit method were employed to solve the governing equations. Ethylene glycol solution, which is utilized as a secondary coolant, was adopted as the testing solution. The analytical results were favorably compared with the experimental ones. It was found that the assumptions adopted in the present study were only available for the conditions under which the dendritic ice layer normal to the cooled plate is formed.

The Development of Computer-Graphic System for Hologram Source Pictures

Yoshinao AOKI and Tomoyuki NARUSE
(Received September 30, 1989)

Abstract

Recently, holograms are used for the description of three-dimensional pictures. And Computer Graphics (CG) technique has found its applications in the creation of CG hologram in which hundreds of pictures generated with CG methodology take the place of material objects in a laser imagery system. The major advantage of CG hologram is that

scenes with animated objects can be simply obtained by changing their positions and orientations in visualizing process, which is difficult for material object holograms.

In the case of generating hologram source pictures by rendering geographical models, special problems arise from the realistic rendering of landscape because of the amount of detail required. In order to authentically describe the geography, a terrain height model should usually be divided into a large number of small patches. Thus the input of these height data is a heavy burden for the rendering program users.

In this paper, we propose a method for fast rendering hologram source pictures used in the production of hologram images. And we discuss the generation of height field detail for geographical model by recursive fractal method of free subdivision, which allows for the original height data input in free order on arbitrary grids. And we prove experiments that the hologram source pictuers of terrain model generated by this method have good quality and authenticity.

Preparation and Thermal Decomposition of Monodispersed, Spherical Particles of Hydrated Alumina

Takeshi TSUCHIDA and Hitoshi BETSUYAKU
(Received September 13, 1989)

Abstract

Monodispersed, spherical particles of hydrated alumina, ~0.7 μm in size, were prepared by hydrolyzing aluminum sulfate solution ($Al_2(SO_4)_3 \cdot 18H_2O$ 1×10^{-3}mol/l) at an elevated temperature of~90℃ in the presence of urea ($CO(NH_2)_2$ 1.5×10^{-1}mol/l). The particles formed were amorphous to X-rays, and on heating showed a DTA endotherm near 200℃ and two exotherms at 862 and 1145℃, which corresponded to the dehydration of amorphous hydrated alumina to amorphous alumina, the crystallization of amorphous alumina to η-Al_2O_3 and the transformation of η-Al_2O_3 to α-Al_2O_3, respectively. η-Al_2O_3 obtained at 900℃ was also monodispersed, spherical particles of 0.6 μm in size.

SEM Observation for the Reaction of Monodispersed, Spherical η-Al_2O_3 with ZnO

Takeshi TSUCHIDA and Hitoshi BETSUYAKU
(Received Sept. 13, 1989)

Abstract

The reaction behaviors of $ZnAl_2O_4$ formation between monodispersed, spherical η-Al_2O_3 (0.6 μm in size) and five sizes of ground ZnO particles (5~10, 10~20, 20~32, 32~45, 105~149μm) were observed with a scanning electron microscope (SEM). It has been found that the use of monodispersed, spherical η-Al_2O_3 particles was favorable for (I) obtaining useful information on the reaction mechanism, because of the ease of SEM observation for the size and fine structure of reaction particles and (II) forming monodispersed, spherical $ZnAl_2O_4$ particles.

An AI Application under a Visual Software Environment

Hiroyuki MINAMI and Masahiro MIZUTA
(Received September 28, 1989)

Abstract

Recently, it has been important for end-users in a computer society to build user-friendly softwares. With respect to it, "Visual programming" is one of the most attractive conception for man-machine interface. Using a pointing device (mouse), and operating objects directly on CRT, we can clearly understand the relation between the action of computer and one's mental image. But, the useful environment itself may simply increase the breadth of operations, so that the end-user may be confused when to use it. For improvement of usefulness, we may assume that a new approach which differs from previous ones should be applied. Thus it is considered that tiny AI programs utilize for its development as a new side.

Then, we add "Validity Check" (tiny AI module) to the data analysis system which is already made, with a point of view that the fusion of "Visual Programming" and AI program is one part of a development of the visual environments. We propose that this module is available for a confidence of operations by examples with executions.

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Kinetics of Homogeneous Short Range Ordering in an FCC Spin System Studied by the Path Probability Method

T. MOHRI*

(Received December 26, 1989)

Abstract

The tetrahedron approximation of the path probability method is formulated and the order relaxation behavior of spin configurations up to the tetrahedron cluster by a flipping mechanism in the fcc disorder phase is investigated.

Clearance Fluctuation and Fluctuating Surface Pressure of a Floating Headslider of a Magnetic-Disk Memory Storage Device

Hisataka TAMURA, Masaru KIYA, Osamu MOCHIZUKI,
Toshinori SHIMONAKA and Hiroshi SAKURAI

(Received December 12, 1989)

Abstract

This paper presents an estimation of the clearance fluctuations of a floating headslider of a magnetic memory device based on the fluctuating surface pressure of the headslider. An experiment using a scale-up model is performed at a Reynolds number of 1.1×10^5, which is the same as that of the prototype magnetic disk. Results showed that the surface-pressure fluctuation can possibly produce rms values of the clearance fluctuation which is about a few percent of the average clearance. The probability density distributions of the clearance fluctuation are also estimated by a Monte-Carlo simulation.

Combined Radiation-Convection Heat Transfer Analysis in a Circulating Fluidized Bed Boiler

Kazuhiko KUDO*, Wen-Jei Yang**, Hiroshi TANIGUCHI*, Hiroshi KANEDA***, Masahiko MATSUMURA* and Ke-Hui GUO*

(Received December 26, 1989)

Abstract

A computer program is developed to analyze two-dimensional combined radiation-convection heat transfer in a circulating fluidized bed boiler (CFBB). The radiative heat transfer in the dispersed system is analyzed by a revised Monte Carlo method, which can accurately predict radiative heat transfer in the CFBB, together with results of convective heat transfer among the gas, the particles and the furnace walls. The convective heat transfer between the particles and the furnace walls are calculated by Martin's model. The temperatures of gas and particles together with wall heat flux distribution are obtained. Theoretical results agree well with the experimental data obtained from Studsvik 2.5MW CFBB.

Steady State Response of a Circular Cylindrical Shell Subjected to Multi Point Harmonic Forces

Gen YAMADA, Yukinori KOBAYASHI and Masaaki HIRAI

(Received December 28, 1989)

Abstract

An analysis is presented for the steady state response of a simply supported circular cylindrical shell. The equations of motion thereof are derived in terms of displacements based on Flügge's shell theory. The free vibration of the shell is analyzed theoretically and its steady state response that is subjected to a harmonic point force is also solved by using Galerkin's method. The present method is applied to the free vibration and the steady state response to forces acting at arbitrary points calculated numerically, and the effects of a point of action and of a phase difference on the response are studied.

Steady State Response of a Spherical Shell

Gen YAMADA, Yukinori KOBAYASHI, and Yoshihiro ONO

(Received December 26, 1989)

Abstract

The steady state response of an internally damped spherical shell is determined by the transfer matrix. For this purpose, governing equations of vibration of the shell are written as a coupled set of first order differential equations by using the transfer matrix of the shell. Once the matrix has been determined by numerical integration of the equations, the steady state response of the shell is obtained together with the natural frequencies in terms of the elements of the transfer matrix of the shell under any combination of boundary conditions. By the application of this method, the dynamic responses and the resonant frequencies are calculated numerically for the shells driven sinusoidally at an edge of the shell.

Influence of Graphite Nodule Size on the Impact Properties of Spheroidal Graphite Cast Iron

Noboru SHIRAMINE* Kazumichi SHIMIZU**
Toshikatsu NARITA*** and Toru NOGUCHI*

(Received December 26, 1989)

Abstract

Charpy impact tests were performed on ferritic spheroidal graphite cast irons with three different graphite nodule diameters, and the influence of nodule size on the transition behavior was discussed. The experiments showed that the transition temperature varied 50 -100°C for 12-50 μm mean graphite nodule diameters while the static strength were almost the same. Fracture appearance and the load vs. time curves showed that the ductile to brittle transition occurs when a limited amount of ductile cracks caused cleavage cracks, and this takes place at higher temperatures in specimens with large graphite nodules. SEM fractography showed that the large graphite nodules make it easier for cleavage cracks to initiate due to the large inter-nodule distance, which makes the plane strain state easy to achieve. In the brittle region, graphite nodules act as barriers to the crack propagation, and the large number of small graphite nodules cause the higher impact values. In the ductile region, a large

number of small graphite nodules causes low resistance to unstable crack propagation because of easy dimple nucleation, and result in lower impact values in V-notched specimens although the effect is not apparent in notchless specimens.

Freezing Heat-Transfer Characteristics from a Convex Surface of Return Bend with a Rectangular Cross Section

Makoto TAGO and Shoichiro FUKUSAKO

(Received December 26, 1989)

Abstract

The present study aims to investigate the freezing heat-transfer characteristics from the convex surface of the return bend which has a rectangular cross section with comparatively large aspect ratio. The experiments were carried out for six kinds of duct heights of 9, 17, 26, 50, 52, and 98 mm, with curvature radius of 45 and 159 mm under the condition that the convex surface was uniformly maintained less than the freezing temperature of water, while the concave surface was insulated. The experimental results indicate that the step-wise ice formation was observed on the cooled surface and also that the average freezing heat-transfer from a convex surface became more effective with decreasing duct height.

MBE Growth of InP Using Polycrystalline InP as the Phosphorus Source

Bing-Xiong YANG, Hirotatu ISHII, Kouichi IIZUKA,
Hideki HASEGAWA and Hideo OHNO

(Received Jan. 5, 1990)

Abstract

Molecular beam epitaxial(MBE) growth of InP on InP substrates was attempted, using polycrystalline InP as the P-source. Thermal cleaning of InP substrates either under As_4 pressure or under P_2 pressure was tried and their effects on quality of InP epilayers were investigated.

In both cleanig procedures, epilayers with good surface morphology were obtained at substrate temperatures ranging from 320 to 400°C, They were of n-type with a carrier concentration of 10^{16}–10^{17} cm^{-3} and a mobility of about 2000 cm^2/vs. No obvious difference

in growth conditions and electrical properties resulted from the difference in thermal cleaning precedures. A detailed X-ray diffraction analysis and XPS analysis indicated inclusion of As in the epilayers obtained from As_4 cleaning, leading to the formation of $InP_{1-x}As_x$ with x being about 0.01 or below.

Atomic Layer Epitaxy of InAs by MOVPE and Growth Mechanism

Yoshinori MATSUBARA, Shu GOTO, Shunsuke OHTSUKA,
Hideki HASEGAWA, and Hideo OHNO

(Received Jan. 5, 1990)

Abstract

Atomic Layer Epitaxy (ALE) of InAs was investigated in a vertical atmospheric pressure Metalorganic Vapor Phase Epitaxy (MOVPE) system under alternate supply of trimethylindium (TMI) and Arsine (AsH_3). From TMI supply dependence of InAs growth rate, ALE growth was realized at 305°C. And ALE growth condition was confirmed from the study of the other growth conditions. All the layers were grown on GaAs substrates. Under ALE growth condition, surface morphology was mirror-like.

The growth mechanism of ALE of InAs is explained by a new model involves homogeneous decomposition of TMI in the vapor phase and subsequent segregation of excess indium onto the growth surface in addition to the GaAs ALE model after Doi et al.

Studies on Pool Boiling Heat Transfer —3rd Report, Proposed Method for Predicting Boiling Curves of Saturated Nucleate Boiling—

Hiroto SAKASHITA and Toshiaki KUMADA

(Received December 25, 1989)

Abstract

A method is proposed for predicting a boiling curve which gives the essential characteristics of boiling heat transfer. The method uses the general correlation, $f(q, \Delta T_{sat}, n, B)=0$, and the proposed correlation composed of active nucleation site density n and superheat ΔT_{sat}. This method can predict a boiling curve of arbitrary combination of liquid

and the surface condition of a heated surface, for the wide range of pressure using one boiling curve given by a combination of a certain liquid and surface.

Comparisons are made with the measured boiling curves from various sources. These comparisons confirmed the usefullness of the present method bor predicting boiling curves with reasonable accuracy.

Prestressing Analysis of Prestressed Concrete Beams Including Anchorage Slip

by Masaiki UEDA* Toshinaga WADA** and Masaaki HIROSE***

(Received December 15, 1989)

Abstract

In this paper, the techniques of analyzing the tension in the prestressed concrete (PC) beams having curved tendons are discussed. The accuracy is higher than any of the past techniques as the precision elements of two kinds of the finite elements for PC beams developed by the authors before are used, and by showing a number of the examples of numerical calculation, some investigations and examinations are carried out.

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Recent Trends in Specifications and Performance of Reciprocating Internal Combustion Engines

Noboru MIYAMOTO, Hideyuki OGAWA,
Kenji YAMAZAKI and Shigeo CHIBA

(Received March 27, 1990)

Abstract

There are numerous details in the specifications and performance of internal combustion engines produced recently in Japan, and there have been remarkable changes with the demand for higher power output, lower fuel consumption, and cleaner exhaust emissions.

This report investigated data for all types of internal combustion engines produced in 1988 and 1983 to analyze the changes in performance and design factors. The results indicated a number of advantageous features to assist in the design and research of internal combustion engines.

Characteristics of Carbon Deposit Formation on Combustion Chamber Wall in a Diesel Engine

Noboru MIYAMOTO, Hieyuki OGAWA, Yasuhiro OHI

(Recieved March 27, 1990)

Abstract

This paper is concerned with the deposit formation on the combustion chamber wall in a small diesel engine.

The effect of the wall surface temperature and the fuel properties on the characteristics of the deposit formation were quantitatively analyzed. In the experiments, a cylindrical plug which can control the surface temperature was installed in the swirl chamber, and the deposition weight was measured for each operating time.

The results showed that the time rate of deposition, which is independent for the surface temperature, is constant until the growth of deposit stops.

However, the maximum deposit weight, i.e. the weight of the deposit when its growth stops depends on the surface temperature.

The time rate of deposition and the maximum deposit weight increased with increasing of volatile temperature and viscosity of the fuel.

Design and Implementation for Scientific Article Data Base

Tatsuki SAITO*

(Received March 31, 1990)

Abstract

Scientific article information data base system ANGEL was designed based on the data base management system ADABAS. It consists of an interactive input and retrieval system, intelligent input system and a system for the generation of a relation matrix. These systems were implemented by NATURAL of ADABAS. ANGEL is available for other scientific article data base systems. Initially, ANGEL was developed as an article data base relating to the sculptural surface generation theory of CAD (Computer Aided Design)/CAM (Computer Aided Manufacturing).

ANGEL is now open for public usage and is used at Hokkaido University Computer Center. In this paper, the design concept of the system and input system of bibliographic items are described, and several results obtained from the system are discussed. The input object of ANGEL is scientific articles written in English.

Design Criteria and Basic Characteristics of Current Source Active Filter

Masaru YAMAJI and Shoji FUKUDA

(Received March 26, 1990)

Abstract

Hitherto passive tuned L-R-C filters have been used for suppressing harmonic currents in power lines. They have, however, some problems : they can compensate for only tuned harmonics, and as they exhibit parallel resonance with inductances in power lines, the resonant frequency components in line currents are enlarged.

In order to solve the problems, an active filter (AF) is promising. AF operates as a current source and creates the compensation currents that are in opposite phase with currents to be eliminated, and injects them into power lines. In this mannner AF can compensate for the harmonics from low order to high order continuously.

In this paper, AF using a current source inverter is described, which has the features of quick responses and high compensation frequencies in spite of its simple PWM control algorithm. Thus, an active filter system in which AF and a high-pass-filter (HPF) are combined is proposed. The system is designed in such a way that AF can compensate for

low order harmonic currents while HPF compensates for high order ones to attain excellent total filter characteristics over a wide frequency range. An on-line PWM control method, and desigh criteria of AF and HPF are also presented. Finally, a prototype filter system is implemened and basic compensation characteristics are seen in experiments.

An Object-Based Concurrent Model with Message-Order Control Mechanism

Shin-ya WATANABE and Eiichi MIYAMOTO

(Received April 6, 1990)

Abstract

In distributed computation, agents (objects) act cooperatively exchanging information with each other. In this case, there is some temporal delay of the information propagation because objects are widely distributed. The delay time is not constant but varies according to situations. Thus, when we construct applications based on distributed computation, we must add instructions for synchronization in the programs. In this paper, we propose an object-based concurrent model which controls arrival orders of messages according to the intention of sender object, and also discuss a mechanism for implementing the model. Using our model makes it possible to represent order of message arrival declaratively.

Thus, it enables us to construct high-level debuggers and verification systems for distributed programs.

An Object-Based Concurrent Model with Meta Level Computation

Yoshinori SHIGETA, Shin-ya WATANABE and Eiichi MIYAMOTO

(Received April 6, 1990)

Abstract

We propose an object-based concurrent computation model with meta level computation based on the 'Kamui88' model. This model has two kinds of meta level computation called Local and Global. Local meta level computation is where a single object is operated on, and Global meta level computation is where the relationships between objects are operated on.

We also present some applications of our model.

An Integrated Distributed Programming Environment using Object Oriented Paradigm

Yasunori HARADA, Shin-ya WATANABE, Kazufumi MITIANI and Eiichi MIYAMOTO

(Received April 6, 1990)

Abstract

For programming in distributed systems, an integrated programming environment is required which compensates for some differences between programming languages and operating systems. We are constructing the Kamui environment, which is an integrated programming environment for distributed processing using object oriented paradigm. The main feature of the Kamui environment is that objects act independently (Kamui88 model) and it introduces 'message protocol' as type system for absorbing some differences between languages and operating systems. We present various ideas for object implementation in the Kamui environment including Kamui-C and Kamui-Shell which have been implemented.

Considerations on a Computer Network System Assisting Education and Studies in the University

Satoru MORIKAWA, Manabu OHMIYA, Yasutaka OGAWA and Kiyohiko ITOH

(Received March 30, 1990)

Abstract

This paper describes how to design computer networks assisting education and studies in a university. At first, we divide functions in the university into two branches. Namely, one is the branch of education and studies, and the other is one of the administration. Furthermore, we present computer systems and constitutions of the computer network that suit each branch and clarify that the electronic mail system is the most important application in each branch. Next, we build an experimental computer network that realizes the computer systems and computer networks mentioned above. In each branch the computer network makes the on-line processes of the work possible. Moreover, the electronic mail systems used in the two networks are compared with each other in regard to their usage and user-interfaces. A gateway processor performs to exchange mails between two different computer networks. As a result, it is shown how to design the computer network in the university.

Neutronics of a Target for a Spallation Neutron Source

Yoshiaki KIYANAGI

(Received March 30, 1990)

Abstract

Neutronic properties of a target for the spallation neutron source are studied to obtain the higlest low energy neutron intensity. Proton energy up to 2 GeV is effective for the production of the low energy neutrons. W and Au have the best neutronic characteristics in the non-fissile materials while U has the better one because of its fission contribution. The best target size and moderator position are also found.

Neutronics of Coupled Liquid Hydrogen Cold Neutron Source

Yoshiaki KIYANAGI, Hideki KOBAYASHI and Hirokatsu IWASA

(Received March 30, 1990)

Abstract

Large enhancement in intensity of cold neutron is obtained by using a coupled liquid hydrogen cold moderator, in which a decoupler is removed between moderator and reflector. The intensity increases further by surrounding the hydrogen moderator with a polyethylen pre-moderator. The intensity of coupled moderator increases by about 5 times that of decoupled one in the cold neutron region. A widening of the pulse width is produced by using the coupling moderator but it is not so large.

This is preferable characteristics for the neutron scattering experiment. It was found that the coulpled liquid hydrogen moderator is a promissing candidate of the cold neutron moderators for the high intensity spallation neutron source.

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On the Development of Experimental System of Groundwater Flow

Noriyasu KATOH*, Masuyuki UJIHIRA*
Kiyoshi HIGUCHI* and Masamitsu NEGISHI**

(Received June 30, 1990)

ABSTRACT

In the scale model study on groundwater flow, it is required to measure the changes of heads of many points in the model as fast as possible. Authors have developed an experimental system which consists of experimental vessel, pressure sensors, A/D converters and a personal computer. As the result of the test of this system, it was confirmed that the time to measure the hydraulic heads of several tens of points and the time to print out the processed data on the plotter at arbitrary time were 0.5 second and 3 minutes respectively. It is considered that this system would be available to evaluate the unsteady flow of groundwater because of its high speed measuring and processing ability.

On Short Range Order Hardening

Junsei TSUTSUMI* and Tetsuo MOHRI*

(Received June 30, 1990)

Abstract

Phenomenological calculation which can introduce the concentration dependence into pair interaction energies is employed to estimate the Short Range Order Hardening for Cu-Au system at 720 K. Also, computer simulation technique is developed to analyze the effect of subsequent dislocations on the SROH. Finally, the deficiencies of the theoretical treatments developed for the SROH are pointed out.

Improvement of Anti-Oxidation Properties of Steels by Co-Diffusion Coating of Cr and Al

Liu Yu Xian*1, Toshio Narita*2, and Tatsuo Ishikawa*2

(Received June 30, 1990)

Abstract

In order to improve anti-corrosion properties of carbon steels, diffusion-coating processes of Cr, Al, and their mixtures were investigated by using a pack-cementation method, where pure Cr and Fe-50 mass%Al alloy powders as well as their mixtures were used for vapor sources of Cr, Al and their mixtures. Diffusion layer thickness and concentration profiles were determined as functions of temperatures, diffusion times, and chemical compositions of the mixtures for co-diffusion of Cr and Al.

Surface concentrations of 17 mass%Cr and 8 mass%Al were obtained when a mixture of 93Cr and 7 (Fe-50Al) powder was used, and this diffusion coating layer was indicated by a corrosion test to be highly protective against high temperature oxidation in air at 800℃.

Electrodeposition of Gallium on Gallium Electrode in Bayer Solution

Hirobumi Mizuno, Takeshi Toyoda,
Takeshi Sasaki, and Tatsuo Ishikawa

(Received June 30, 1990)

Abstract

In order to remove materials coexisting in Bayer solution which may restrain the electrodeposition of gallium on a gallium electrode , Bayer solution was cooled at various temperatures with or without sodium salts of coexisting materials as a seed for crystallization.

The concentrations of vanadium, arsenic, and phosphorous decrease to 1/5~1/2 of original concentrations by cooling at −20°C for about one week. The electrolysis by using a gallium electrode in the Bayer solution as treated at −20℃ achieves the electrodepositon of gallium at lower potential than −2.1 V vs. Ag-AgCl. The largest current efficiency as 0.06 ~ 0.08% is observed at −2.1 V electrolysis.

Soot Formation Characteristics in Hydrocarbon-Air Premixed Combustion

Noboru MIYAMOTO, Hideyuki OGAWA and Kazuharu SUZUKI

(Received June 30, 1990)

Abstract

The soot formation processes for 12 kinds of hydrocarbons were measured optically to determine the effect of fuel properties on soot formation. In the experiment, a disc-shaped constant-volume chamber with 8 spark plugs for ingition around the side casing was filled with a rich hydrocarbon-air mixture. The soot concentration at the center of the chamber was measured with laser light extinction.

The results showed that differences in the critical equivalence ratios for the onset of soot formation ϕ_c in different kinds of fuels were relatively small.

However, with higher equivalence ratios than the critical value ϕ_c, the soot-conversion ratios of the fuels with lower critical equivalence ratio tended to increase more.

The effects of C/O and C/O* ratios in the overall mixture on the soot-conversion ratios were also investigated for different mixture strength. Here, O* is the number of oxgen atoms in the mixture extracting half the hydrogen atoms in the fuels. The critical C/O ratios for the onset of soot formation were almost the same for different fuel properties, and the soot-conversion ratio increased similarly with increased C/O ratio in different fuels. The critical C/O* ratio was about 1.0 for aromatic fuels and about 2.0 for other fuels.

An Experimental Study of Ice-Layer Transition Phenomena

Makoto TAGO and Shoichiro FUKUSAKO

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Abstract

An experimental study is performed to investigate the ice-layer transition phenomena observed in a channel which has a lower cooled wall. The rectangular test channel with cross-sectional dimensions of 50 mm by 19 mm was used in the present measurements. The velocity distribution and the turbulence intensity in a flow passage were measured using the Laser Doppler Velocimeter set up on the two-dimensional traversing device. The freezing experiments were carried out under the condition of constant amount of flow even after the ice-layer developed in the channel. From the present measurements, it was found that onset

of the ice-layer transition might be quite closely related to the increase of the turbulence intensity in a flow along the developing ice-layer surface.

An Experimental Study on the Application of Genetic Algorithms to a Scheduling Problem

Masaaki MINAGAWA and Yukinori KAKAZU

(Received June 30, 1990)

Abstract

This paper intends to explore a new scheduling algorithm for the Job-Shop Scheduling problem and to provide some analyses to obtained experimental results. To guide scheduling solution search effectively and to obtain near-optimal solutions, we adopt Genetic Algorithms (GAs) which mimic natural evolution process.

Evaluation functions for the search are weighted using bit strings and these strings are manipulated by genetic operators such as reproduction, crossover and mutation. So as to follow the change of input job characteristics and keep obtaining better scheduling performance, the weights are automatically tuned by the algorithm. Based on the experimental results, some useful conclusions are drawm.

Investigation of the New Accelerated Fatigue Tester for the Prosthetic Heart Valves

Yukiaki KIKUTA, Toshio YUHTA,
Toshiyuki SHIMOOKA and Yoshinori MITAMURA

(Received June 30, 1990)

Abstract

A new accelerated fatigue tester for prosthetic heart valves was developed. The test apparatus consists of a single phase induction motor, a water supply duct rotor and two heart valve housings. The test can be performed at cyclic rates of 435 (rpm) and 580 (rpm) using water. The pressure across the valve and the valve opening and closing were monitored to evaluate characteristics of the tester. The tilting disc valves which have a thin occluder

(0.70(mm)) and a thick occluder (1.35(mm)) made of duralumin were used in this study.

There was no difference in characteristics of the valves between a thin occluder and a thick occluder. The valves completely opened and closed at the cyclic rates. The water hammer pressures were observed as the valves closed. They increased in proportion to the initial inflows and decreased in proportion to the cyclic rates.