Abstracts of Papers in English

COMPARISON BETWEEN EXPERIMENTAL AND NUMERICAL STUDY OF DAMAGED EXTERIOR BEAM-COLUMN BY FRP LAMINATE

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Key Words: Earthquake, Damage, Beam-Column, Connection, Repair, Strengthening, Retrofitting, Reinforce Concrete, Fiber Polymers, FRP

Abstract

In this study, the use of the FRP laminate technique in repairing a reinforced exterior beam-column joint which has been damaged by simulated seismic load, is investigated, experimentally and analytically. Areversed cyclic load was applied to the tip of the full scale exterior beam-column specimen. Cyclic loading continued until the ultimate capacity of the specimen was reached. Then, the specimen was repaired by using CFRP laminate. The repaired specimen was subjected to cyclic loading. For an analytical study of the same beam-column specimen, the finite element model was prepared. The model was calibrated by using the result of the experimental test. For the effective ness of the CFRP arrangement on the behavior of beam-column connections, five nonlinear analytical models, with different CFRP arrangement under reserved cyclic loading, were studied. The results indicate that using CFRP laminate was effective in restoring the strength, energy dissipation. Comparisons between the capacity of the numerical model using different arrangements of CFRP laminate, are mode.

STANDARD PENETRATION NUMBER CORRELATION WITH PROBABILITY OF LIQUEFACTION OCCURANCE USING RELIABILITY METHOD IN SANDY SOIL

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Key Words: Reliability Analysis, Liquefaction Potential, Reliability Index, Uncertainties, Safety Factor.

Abstract

Methods of evaluating the liquefaction potential in sandy soil is generally based on deterministic analysis. In deterministic analysis, parameters are considered precise, without variance and error. As well as using these methods, one is unable to make a connection between the probability of liquefaction occurance and the safety factor. This problem can be answered by reliability analysis. In this paper, reliability analysis, based on the popular Seed'85 method of liquefaction evaluation, using standard penetration test results, is offered. Since this method requires quantifying uncertainty values in calculation, one can use the statistical moment of undeterministic parameters, such as the mean, variance and probability density function (PDF), for determination of the most probable uncertainties. Then, using the ad-

vanced, first-order second-moment (AFOSM) technique, the reliability index is calculated and the relation probability of liquefaction occurance, reliability index and safety factor are deduced. For analysis of the data, statistical regression is used to establish a relationship between earthquake characteristics, resistance and the potential of liquefaction occurance of the soil, based on the proposed method and 180 field records in the Babolsar region. A comparison between the proposed method and the previous method shows good agreement.

DISCONTINUITY CLUSTERING IN ROCK MASSES WITH THE APPLICATION OF KOHONEN NEURAL NETWORK UNDER THE FRAMEWORK OF PROBABILITIES

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Key Words: Discontinuity, Neural network, Contouring, Stereographic.

Abstract

Distinct clustering of discontinuities is very useful for analyses and the design of the foundation of structures or rock masses. A traditional method is contouring a number of significant pole densities plotted on the stereonet.

The use of different techniques for contouring a poles plot generates different results. Therefore, in this paper, artificial intelligence methods, with the application of probabilities, are used to cluster the discontinuities. One of the advantages of this method is to determine the accurate number of discontinuity clusters, the belonging of each discontinuity to a specific cluster and its dependence on the distribution of data.

MODELING TRANSIENT MIXED FLOW IN CLOSED CONDUIT

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Key Words: Mixed flow, saint-venantequations,slot, preseman scheme

Abstract

Transient mixed flow occurs under particular conditions in a closed conduit, in which both free-surface and pressurized flow come into existence simultaneously. Depending on the origin of the mixed flow, systems experiencing this phenomenon may encounter several problems. Successful simulation of mixed flows is, therefore, necessary to predict and overcome the problems encountered. Different methods are suggested for the simulation of the mixed flows.

In this research, the transient mixed flow in closed conduits has been analyzed by the slot method. The capabilities of the proposed model are assessed by the results of a physical model and the results are presented. The model is further used for the prediction of a transient mixed flow in a real-word pipeline system. The results are then used for devising some operational guidelines.

STRAIN INPUT ENERGY IN NEAR-FAULT GROUND MOTIONS

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Key Words: Fault, Ground Motions, Structur, Strain Energy.

Abstract

The effect of near-field earthquake records on the strain input energy of structures is investigated in this paper. Near-field records differ from other types of record by special characteristics. Long-period pulses, which are added to background records, are examples of those special features that are studied in this paper. Although both pulses and background records are statistical objects, the pulses usually behave more deterministically than underlying records. Considering this point, it is reasonable to compute the response of a structure to such earthquakes in two steps (i.e. deterministic and probabilistic phases) and, then, superimpose the results. Handling responses to near-field records in this way leads to more accurate response evaluations, because of extracting the deterministic part of the results from the statistical procedure. For this purpose, the response of different structures to near-field records is evaluated and the results are proposed in the form of energy spectra. The findings show that, in near-fault zones, an increase in ground motion magnitude results in higher spectral peak strain energy and, also, a higher period of occurrence, respectively. It is found that, close to the fault,

the response is primarily governed by the pulse characteristic rather than by the background record. This trend inverts gradually as the distance to the fault increases. In intermediate regions, the energy spectra experience two major peaks, which correspond to the site dominant period and the pulse period, correspondingly.

THERMO-HYDRAULIC MODELING OF PHASE CHANGE MICROPUMP

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Key Words: Mircopump, Phase Change, Modeling, Dimensional Analysis, MEMS.

Abstract

Recently, non-mechanical micropumps have become more appealing, due to their advantages in many areas such as electronics and medicine. In this research, a phase change micropump, as a novel type of non-mechanical micropump, has been investigated. Dimensionless parameters have been determined using dimensional analysis and a one dimensional steady model has been developed to describe the pumping mechanism and assess the working characteristics of the micropump. The results show that the theoretical model is in reasonable agreement with the experimental investigations. This analytical approach can be used in the design and fabrication of more efficient micropumps.

SIMULATION OF ULTRAVIOLET RADIATION EFFECTS ON MECHANICAL PROPERTIES OF GLASS/POLYESTER COMPOSITES

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Key Words: Ultraviolet Radiation, Glass/Polyester composites, Tensile Strength, Stiffness, Shear Strength, Ultraviolet Absorber Additives.

Abstract

In this research, the ultraviolet radiation degradation effect, as an environmental impact on the mechanical properties of Glass/Polyester composites, is studied. Various samples are manufactured using polyester resin and exposed to ultraviolet radiation. In order to measure the residual strength of the material, the samples are exposed to ultraviolet radiation in the test chamber for a time equal to three, six and twelve months of the real life. Residual strength tests are performed on the radiated and virgin samples in order to compare the strength of these two types of specimens.

After measuring the mechanical properties of the virgin and radiated samples, the mechanical properties of unidirectional and $[0/90]_s$ cross-ply Glass/Polyester laminated composites are analyzed using Micromechanical and Classical Lamination Plate theories. The results of the analysis are evaluated by performing experiments on the unidirectional and $[0/90]_s$ cross-ply Glass/ Polyester laminated composites. The results of experiments show a considerable loss in transverse stiffness and shear stiffness of the unidirectional and $[0/90]_s$ cross-ply Glass/Polyester composites. The results of the experiments also show that adding ultraviolet absorber additives to the polyester resin prevents the mechanical degradation of the resin under ultraviolet redaction very well.

STATIC SURFACE PRESSURE MEASUREMENT ON A SECTION OF A WIND TURBINE BLADE

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Key Words: Wind turbine, Wind tunnel, Pressure distribution, Lift coefficient, Wake

Abstract

An extensive experimental investigation has been conducted to study the aerodynamic behavior of a wind turbine blade. A three dimensional wing was fabricated using the existing wind turbine blade cross section. The wing was tested at angles of attack of -5 to 25 degrees and at various Reynolds numbers in the Shiraz subsonic wind tunnel. Experimental results, such as static pressure distribution, lift coefficient, wake and 3-D flow effects, are compared with the 2-D test results. The comparison shows that 3-D flow effects reduce both wing lift coefficient and blade performance, with respect to the 2-D results, while the stall angle increases considerably.

FATIGUE FAILURE OF FOAM CORE SANDWICH COMPOSITES WITH UNSYMMETRICAL HYBRID FACES UNDER TENSION-TENSION LOADING

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Key Words: Sanwich composites, Tension-Tension fatigue, Unsymmetrical hybrid faces.

Abstract

In this paper, the fatigue response of a foam core sandwich composite with unsymmetrical hybrid faces has been investigated. The sandwich laminates were manufactured using the same method for a corresponding selected element in a real composite structure.

Two similar woven E-glass fibers (designated by G1& G2), following unidirectional carbon fibers (C) with Epoxy resin, were used as the face sheet over a PVC foam core. The lamination sequence and angles are, as follows, respectively: [G1/C/C/C/G2/ Foam /G2/C/C/G1], [0/0/0/0/± 45/Core/±45/0/0/0]. Extensive fatigue data were generated for the S-N diagram for such a laminate. Based on static analysis of the two FEM models, critical points in the specimen causing static failure were explained. The effect of using each of the two different proposed designs for specimens were shown. FEA and experiments results both give an improvement in the failure zone and strength values for an oblique type design of the gauge interface. The failure modes, after final failure of the sandwich laminate, have been discussed. From four types of damage recognized for the laminate, two of them were nucleated and grown in the foam core, first in thickness and then parallel to the length of the gauge. By increasing the overall stress level, the parallel cracks were shortened.

COMPARISON OF THE PETER AND THEODORSON AERODYNAMICS IN DETERMINATION OF AEROELASTIC INSTABILITY

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Key Words: Incompressible Flow, Peter's Theory, Theodorson aerodynamic, Instability

Abstract

In this study, the instability boundary of a wing - in the incompressible flow regime has been considered, using Peter's aerodynamics, and compared with the result obtained from the Theodorson aerodynamic. To this aim, the lift coefficient, based on Peter's theory in the frequency domain, is obtained, at first, for a pure plunging motion. Then, real and imaginary parts of the lift and moment are plotted versus reduced frequency and compared with those from the Theodorson aerodynamic. It can be seen that, with a fewer number of aerodynamic states in Peter's theory (N=5) , there will be good agreement between the two theories. In addition, equations corresponding to mass, stiffness and damping matrices from Peter's theory have been obtained. To do this, two models, including a typical section and beam, are used for structural modeling. Finally, the flutter boundary is determined using $p-k$ and p methods and the results compared with those from the Theodorson aerodynamic. Results show good agreement between the two theories.

SHIP MOTIONS SIMULATION USING FINITE VOLUME SOLVER

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Key Words: Finite Volume Method, Free-Surface, Moving Grid method, Numerical Hydrodynamics

Abstract

In this paper, an integrated computational procedure for the simulation of a two-phase flow, as well as floating and submerged body motions, is presented, based on a Volume of Fluid (VoF) - fractional step coupling. Two fluids are modeled as a single continuum, with a fluid property jump at the interface, by solving a scalar transport equation for the volume fraction. In addition, the conservation equations for mass and momentum are solved using the fractional step method. Based on the integration of stresses over a body, acting forces and moments are calculated. The strategy of non-orthogonal body-attached mesh and calculation of the motions at each time step, result in the time history of floating or submerged body motions.

The motion simulation strategy is evaluated by using a cylinder water entry test case. To demonstrate the capability of the simulation, barge resistance is also calculated in two cases of fixed and free motion (2-DoF).

All of the results are in good concordance with experimental data. and the present method can be extended for the full nonlinear motion of ships in waves.

STUDY OF PROPELLER INSTALLMENT ANGLE AND ITS 3-D AERODYNAMIC INTERFERENCES WITH A FLYING-BOAT EMPUENNAGE IN GROUND EFFECTS

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Key Words: Proeller, Flying-Boat Empuennage, Aredynamic Coefficients, Interferences, CFD

Abstract

The solution of three-dimensional Navier-Stokes equations is obtained and used to study the aerodynamic interference between a propeller and an empunage. Results show that this interference is quite important, especially when the components are in ground effect. The propeller should be positioned in such a way to reduce the negative aspect of the interactions while, at the same time, keeping the lift and drag within an acceptable range. Using computed flow fields, the proper direction of the propeller, regarding the above criterion, is determined.

In this study, the flow field around a propeller-empunage combination in ground effect, using 3.1 million cells on a cluster of workstations, is obtained and presented.

A COMPARISON BETWEEN DIFFERENT METHODS OF ASSESSING THE IMPACT OF INPUT FEATURES IN FEEDFORWARD NEURAL NETWORKS USING GEOTECHNICAL DATABASE

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Key Words: Sensitivity Analysis, Weight Product Method, Composite Clay, Shear Modulus, Damping Ratio.

Abstract

The back-propagation neural network (BPNN) has been researched and applied as a convenient tool in a variety of application areas in civil engineering. In particular, BPNN has been applied to many geotechnical engineering problems and has demonstrated some degree of success. A review of the literature reveals that BPNN has been used successfully in pile capacity prediction, modeling soil behavior and liquefaction, etc. However, learning algorithms, such as the BPNN, do not give information on the effect of each input parameter or influencing variable upon the predicted output variable. In other words, it is not possible to find out immediately how the weights of the network or the activation values of the hidden neurons are related to the set of data being handled. Instead, ANNs have been presented to the user as a kind of 'black box', whose extremely complex work transforms inputs into predetermined outputs. To deal with this problem, during the last 10 years, different interpretative methods for analyzing the effect or importance of input variables on the output of a feedforward neural network have been proposed. In this paper, six methods that give the relative contribution of the input factors were compared. The data used for training the networks is based on the laboratory tests for determining the dynamic properties of aggregate-clay mixtures. Finally, the method which best interprets the networks is introduced.

SHOCK FITTING AND SHOCK CAPTURING SCHEMES FOR COMPUTATION OF HYPERSONIC AXISYMMETRIC FLOWS OVER BLUNT NOSES INCLUDING REAL GAS EFFECTS

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Key Words: Hypersonic Flow, Blunt Bodies, Equilibrium Gas, Shock Fitting Technique

Abstract

In this study, the numerical simulations of hypersonic axisymmetric viscous flows over blunt noses, including equilibrium gas effects, are performed by using shock fitting and shock capturing schemes to examine the effects of shock boundary treatment on the accuracy of computations. The numerical solution of the thin-layer Navier-Stokes (TLNS) equations in the nose region is obtained by using the implicit non-iterative finite-difference algorithm of Beam and Warming and an appropriate formulation of the shock boundary condition for the shock

fitting procedure, with considering real gas effects, is implemented. The thermodynamic and transport properties of air are calculated by using the simplified curve fits developed by Srinivasan et. al.. The numerical solutions of hypersonic equilibrium flow over a sphere at Mach number of 16.89 are performed and the calculations for the flowfield and the shock shape are compared with available numerical results. The computations are presented for both equilibrium and perfect gas models and the results of flowfield and shock shape for the shock fitting and shock capturing procedures are compared with each other. In addition, the role of numerical dissipation and the effects of grid size on the accuracy of the results are investigated.