to investigate the deformations, axial and shear forces, bending moments and stresses in each of the above construction stages, the stability of the natural trench before construction, the interface between corrugated steel plates and the soil, the assumption of the elastic behavior of backfilling, the effect of unbalanced backfilling, and the effect of the asymmetry of construction loads, have also been studied. The comparison indicates that horizontal and vertical displacements and the compressive stresses obtained from FE stage construction are 64, 43 and 56 percent, respectively, greater under standard limitations. Therefore, a more optimum and economic design, in comparison to elasticity based analysis methods, can be achieved by accounting for stage construction and the nonlinear behavior of soil-steel bridges.

Key Words: Soil-steel bridges, static analysis, Finite Element method, truck load.

Abstract

Basin-scale river basin simulation models are vital tools in assessing and quantifying large-scale water resource systems performances under different scenarios. However, simulation models are not capable of doing multi-period optimization for optimal planning and management purposes. Linking river basin simulation models to multiperiod optimization algorithms could be a remedy to such shortcoming. Nevertheless, large-scale river basin models, when used as the simulation model of an optimization algorithm, may face difficulties, in terms of the needed time for combined optimization-simulation models to run. The more hydrologic and socio-economic processes to be addressed in the simulation model, the more the computational burden of the combined model would be. Meta-modeling is one of the useful approaches to dealing with this difficulty, where a fast-running approximate model, called meta-model, replaces the exact simulation model. This study presents application of the particle swarm optimization (PSO) algorithm, linked to the MODSIM decision support system (DSS), as a river basin simulation model, resulting in the integrated PSO-MODSIM optimization-simulation model, for solving basin-scale water allocation problems. The developed model was applied to the problem of optimal water resource development plans, as well as optimal water allocation of the Atrak River Basin, as a real case study in north-east Iran. Where there are serious competitions between upstream and downstream provinces of the basin in utilization of available water resources. The objective function of the model, which consists of design variables; i.e., reservoir capacities, and operational; i.e., priority numbers of reservoir target levels, was calibrated based on improving water allocation conditions compared to a benchmark scenario, in which development projects were not implemented. Since the integrated model was time consuming, support vector machines (SVMs) were used as a meta-model to develop the PSO-MODSIM$\sim$ SVM model, in which an SVM-based surrogate model replaces MODSIM. The performance of the PSO-MODSIM, PSO-MODSIM$\sim$ SVM and another model, with a meta-model of artificial neural network (ANNs) type, were analyzed and compared through their application to optimal water allocation and planning water resource development projects in the basin. Before using SVMs as a meta-model, we first showed how well they perform in approximating benchmark multidimensional mathematical functions. Then, basin-scale optimal water allocation problems were solved using surrogate optimization techniques. Both SVM and ANN models were able to approximate and represent the MODSIM DSS reasonably. However, the results show that SVM-based surrogate optimization has performed satisfactorily in terms of both the quality of the solutions and the saving in computational burden compared to the model employing ANN as the meta-model.

Key Words: Water allocation; river basin; surrogate optimization; support vector machines.

STATIC ANALYSIS OF SOIL-STEEL BRIDGES UNDER CONSTRUCTION LOADS

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Abstract

Soil-steel structures are composite structures made by steel rings and a soil envelope, which are constructed in spans of, maximum, thirty meters. Soil-steel interaction causes flexible steel plates to interact with the surrounding backfill for suitable distribution of external loads in a radial direction. Internal forces and deflections are of the most concern in analytical study of soil-steel structures. But, only precise modeling makes results reliable. The current methods of analyzing these types of structures are principally based on the elasticity theory, in which nonlinear interaction of soil-structure and stage construction of local effects are not taken into account. These are the main concerns of the present research. In this paper, introducing soil-steel structures for bridge construction, the behavior of such structures is investigated under stage construction loads. As a case study, a single span soil-steel bridge has been analyzed and designed, based on the Canadian highway bridge design code (CHBDC) and results are compared with the PLAXIS finite element code. Stage construction consists of 1) the initial phase where a natural trench has been idealized; 2) filling and compaction of soil under foundations; 3) construction of foundation and installation of plates; 4) backfilling and compaction of both sides of the steel structure up to crown level; 5) backfilling the soil cover up to a minimum height of cover for construction loads; 6) backfilling and compaction of soil cover up to the final level for performance loads. In addition

the same results in perfect plastic assumption, but different results in brittle assumption. Specifically, the obtained deformations and plastic zone are highly dependent on post-peak residual parameters. The strain softening behavior, as an intermediate condition between perfect plastic and brittle conditions, was considered as well. In this research, it was observed that the available numerical codes usually exhibit non-symmetric results in very low residual parameters, even for symmetric loading. This can be attributed to the weak points of these numerical codes.

Key Words: Deep tunnel, brittle behaviour, hard rock, $PHASE^2$, FLAC.

EFFECT OF DAMPING ON SENSITIVITY REDUCTION OF ACTIVE STRUCTURAL CONTROL TO TIME DELAY

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Abstract
Time delay is a major problem in active structural control, which may lead to an inactive control performance or even result in instability of the whole structure. Sensitivity of structures to time delay may refer to characteristics of the building, the control system, and/or external loadings. If a control system is designed based on the ideal parameters of the building and control mechanism, it may be inefficient, because it does not take note of the practical problems encountered in reality. But, if a control system is perfectly designed, it may suffer from some changes in structure and/or control parameters. Hence, time delay may always affect the performance of a controlled structure. In this paper, in order to evaluate the influence of this effect, sensitivity analysis of an eight-story model building, with respect to time delay, is carried out. The control system is an active mass damper/driver (AMD) installed on the top floor. The control algorithm is the discrete instantaneous optimal control (DIOC) method, previously presented by the second author. This algorithm is powered using stable matrices to overcome the time step problems that the instantaneous optimal control methods confront.
First, a critical time delay is recognized, in which the controlled structure is unstable. By changing input excitation (strong ground motion), the effect of input seismic load on critical time delay is examined. Using different earthquake loads: El Centro, Parkfield, and San Fernando, results in the same critical time delay for the mentioned buildings. Then, the stiffness of the building stories are increased without changing the mass of the floors. It is recognized that there is a relation between critical time delay and the first period of the controlled building. The proposed coefficient is about $\frac{1}{7}$ to $\frac{1}{6}$ of the fundamental period of the controlled building.
Second, by introducing passive dampers in such a manner that the capacity of the energy absorption of the building is increased without increasing its stiffness, critical time delay is evaluated, again. There is no change in critical time delay, but extensive results show that increasing damping to a large extent may alleviate the sensitivity of the controlled building to time delay. In other words, increasing the damping of the first mode of the controlled building may extensively increase the efficiency of the control system. Hence, this may be a good solution for older active control buildings, which suffer from time delay effects.

Key Words: Active control, time delay, passive damping, control algorithm, stability, discrete instantaneous optimal control, DIOC.

SUPPORT VECTOR MACHINE -BASED META-MODELING FOR BASIN-SCALE OPTIMUM WATER ALLOCATION

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In two recent decades, a new method has been invented which is called Active Structural Control. Applying the external force, when it is needed; not only can reduce the response displacement but also is able to make a high reduction in response velocity and acceleration. Predict the building behavior during an earthquake event has an important role in order to have a safe structure. The structure engineers usually use two methods to compute the structure response: i) Dynamic Analysis or ii) Nonlinear Static Analysis. Since the dynamic analysis depends on several items such as frequency content of earthquake record, the most structure specialists prefer to employ the nonlinear static analysis (pushover analysis) to compute the target displacement in IO, LS and CP levels.

The essential goal of this research is to create a combination between active structural control concept and nonlinear static analysis. Three reinforced concrete buildings with 4, 8 and 12 floors are selected. All buildings have three bays and are analyzed using the pushover method and for each case a performance level is found. The main purpose of using active structural control equipment in the selected buildings is to keep the building performance in that limit which is found at the analytical part.

An important aspect of this investigation is the incorporation of the possibility of inelastic deformation of the members into the control algorithm. In analytic investigation, in order to solve the control formula, the Instantaneous Optimal Control algorithm is employed which is conducted to introduce "c/r" ration. This ratio shows the importance of the amount of control force against the importance of reduction in structural response. The results show that the best c/r ratio for the selected structures is between 1×10^9 and 5×10^9 which can keep the structures in IO performance level. Generally, the optimal amount of c/r ratio to get the target performance level depends on different items such as the primary strength of structure (the initial performance level) and probable seismic hazard, therefore; it seems that the hazard risk analyses is necessary as an additional analysis.

Key Words: Active control, performance based design, target displacement, instantaneous optimal control algorithm, performance level.

NUMERICAL STUDY OF HARD ROCK BRITTLE BEHAVIOUR ON DEFORMATION AND THE PLASTIC ZONE AROUND DEEP TUNNELS

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Abstract

Estimation of stress and deformation in rock mass around deep tunnels is of great concern in geotechnical engineering, rock mechanics and mining engineering. Due to large stresses in these tunnels, the surrounding rock mass may experience failure in some points. Hence, in these tunnels, the failure process is of great importance. There are different rheological models to simulate the failure behavior of rocks, including perfect plastic, strain softening and brittle models. Since many rocks in nature are hard, with brittle behavior, it is required to select a suitable mechanical model for simulating such behavior. In this research, the post-peak behavior of hard rocks is studied using the numerical methods of FEM and FDM, with $Phase^2$ and FLAC codes. The effect of brittle behavior is evaluated on deformation and the extent of the plastic zone in deep tunnels excavated in hard rock. Then, these results are compared with those obtained based on perfect plastic assumption. Due to the fact that the rock strength after failure decreases to a residual level, different residual values are considered, in order to show the importance of selecting the correct residual parameters. Firstly, a circular tunnel is analyzed by both numerical and closed form methods and the obtained stresses and displacements are compared. In addition to tunnel wall deformation, the radius of the plastic zone is evaluated. In this circular tunnel, deformation of the tunnel wall with brittle assumption is obtained twice greater than the results based on perfect plastic assumption. This ratio is decreased at higher radial distances. Moreover, radial stresses in brittle condition are lower than values obtained in perfect plastic condition. Also, tangential stresses in the yielded zone are lower than those stresses in the elastic region, because of stress redistribution. In this paper, a parametric study is accomplished on a horse-shoe tunnel, with both Mohr-Coulomb and Hoek-Brown failure envelopes. The rock is assumed homogenous and isotropic with a non-associated flow rule. The Cai et. al. approach was adopted to estimate the peak and residual strength values of the rock mass. The importance of selecting correct residual strength is again presented. This study illustrates that numerical and closed form methods submit

Key Words: Mesostructure, compressive strength, concrete, finite element method, plastic-damage.

EVALUATION OF THE EFFECT OF GEOMETRIC CHARACTERISTICS OF A PILED-RAFT ON ITS BEHAVIOR ON SOFT CLAY UNDER DRAINED CONDITIONS

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Abstract

Combined piled-raft foundations (CPRF), is an innovative idea proposed since the 1970s. Adding piles to raft foundations contributes to settlement reduction and an increase in the bearing capacity of the raft. Generally speaking, CPRF helps in considerably reducing the number of piles and pile lengths, improving serviceability in both total and differential settlements, and minimizing tilt and instability probabilities. Reduction in the number and length of piles also contributes to considerable saving in construction cost. The applicability of the construction of piled-raft foundations on soft clay has been under greater attention in recent years. Lack of sufficient stiffness for soil and, thus, excessive settlement, allowing mobilization of pile loads, is a major concern in this regard. This paper presents a numerical investigation into the effects of geometrical variations of piled-raft components on soft clay, as a parametric study.

A 3D FEM numerical model is developed using ABAQUS. The model was calibrated by comparing physical and numerical modeling of other researchers. An elaborate parametric study was then conducted to evaluate the effect of various parameters on CPRF applicability on soft clay. In this study, attention was focused on the drained (long-term) response of a piled-raft resting on a soft clay layer, so the clay was idealized using drained shear strength parameters, c' and ϕ Thus, consolidation effects were neglected. In all analyses vertical uniform loading was applied to the top of the raft surface. The results indicate that pile arrangements under the raft play an important role in piled-raft performance. An increase in pile length and diameter results in settlement reduction and an increase in the pile contribution ratio. An increase in raft thickness reduces differential settlements, but has no considerable effect on the pile and/or raft bearing ratio.

Overall, the construction of pile-rafts on soft clay is promising, as long as the total settlement of the structure is not imposing restrictions, such as the common 20 mm allowable settlement. But, instead, if the allowable settlements are in the range of 100 to 150 mm, for example, in the case of rigid steel tanks, the method will be applicable, with considerable cost and construction time savings.

Key Words: Piled-raft, soft clay, numerical modeling, parametric study.

IMPROVING PERFORMANCE OF STRUCTURES USING ACTIVE INSTANTANEOUS OPTIMAL CONTROL

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Abstract

During recent earthquakes, the behavior of structures has demonstrated that the main reason for building collapse is the big deformation during strong seismic events. Therefore, the structural designers would like to reduce the lateral displacement of structures under a specified level. Using the shear walls and bracing and increasing the members size are the common ways which can protect the buildings against the earthquake or wind load.

in the downstream of a dam. Understanding the basic characteristics of dam-break flow, such as maximum water level, maximum discharge and the arrival time of the wave front around the obstacle, such as the bridge pier, at assigned locations, is fundamental to a reliable engineering design. Therefore, it is necessary to determine the extent of damage in cases of possible dam failure around obstacles. In the present study, experimental results of a cylindrical bridge pier with a diameter of 4cm have been modeled in a rectangular flume. The mentioned pier was located 108cm from the gate and made of plexiglass in the downstream.

The experiments were carried out to assess flow propagation along the flume and around the pier under dry bed conditions in the downstream reach. Also, effects of an initial upstream depth on flow propagation were investigated. Dam failure was simulated by sudden removal of the gate that separates the reservoir from the channel, by means of a pneumatic jack. The gate was made of plexiglas plate in order to keep gate-water interference at a minimum level.

Variations in water surface were recorded using ultrasonic sensors and a high speed camera. In addition, an ADV sensor has been used for recording the velocity components at different locations.

Flow results show the significant effect of the bridge pier on the flood wave induced by the dam break. It caused a change in flow direction and made a slight increase in water depth. Also, the wake zone is observed behind the bridge pier at a distance of 13 times the pier diameter. In addition, experimental data are compared with the analytical solution proposed by Ritter. This comparison shows a very small difference (4-12%) between experimental results and the Ritter solution in the distance between the dam reservoir and the bridge pier location. However, at the distance of 13 times pier diameter behind the bridge pier, due to the existence of the wave zone, the difference percentage is increased.

Key Words: Dam break, bridge pier, ultrasonic sensor, CCD camera, ADV sensor

NUMERICAL STUDY OF MESOSTRUCTURE EFFECTS ON CONCRETE COMPRESSIVE STRENGTH

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Abstract

In the present paper, the detailed mesostructure of concrete is geometrically generated and its compressive strength is numerically estimated using the 3D finite element method. The models contain two phases of mortar and coarse aggregates. The FE models of concrete are cubic in shape, with a side length of 80 mm. Aggregates are assumed to be spherical and behave in a linear elastic manner. The famous Fuller formula is utilized for the aggregate grading curve, and the simple sequential inhibition (SSI) technique is employed to fill the concrete cubes with the particles. Only aggregates bigger than 4.75 mm in diameter (gravel) are modeled, i.e., the particles smaller than 4.75 mm in diameter (sand) are not considered individually and assumed to be part of the homogenized nonlinear cement paste. A modified version of the plastic-damage model, proposed by Lee and Fenves [J. Lee, G.L. Fenves, International Journal for Numerical Methods in Engineering 50 (2001) 487-506], has been adopted to simulate the inelastic response of the mortar. This constitutive model incorporates two independent hardening variables, namely; equivalent tensile and compressive plastic strains, and, thus, is capable of tracing damage evolution due to both tensile cracking and compressive crushing. In the first stage, the numerical implementation of the plastic-damage model is presented and then its validity is examined in a 3D FE element. Next, the effects of aggregate volume fraction, aggregate maximum diameter, and aggregate elastic modulus on concrete compressive strength are studied. It is shown that: (1) compressive strength remains constant for specimens with aggregate volume fractions of up to 50%, and then increases significantly with grain content, (2) for the range of aggregate volume fractions studied in this paper, the maximum aggregate size has little influence on compressive strength, and (3) any increase in the elastic modulus of aggregates accentuates stress concentration near the aggregates, and, thus, reduces the compressive strength of concrete samples. Finally, the results are satisfactorily compared with those presented by other researchers.

Key Words: Index properties, consolidation behavior, contaminated clays, organic fluid, viscosity.

SYSTEM IDENTIFICATION AND DAMAGE DETECTION OF BRIDGE CONCRETE PIERS, USING TIME -FREQUENCY REPRESENTATION AND A NEW MODIFIED MATRIX SUBTRACTION METHOD

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Abstract

In this research, a new modified matrix subtraction method is proposed using square time-frequency representations to detect bridge pier damage and its location. The new proposed method is confirmed, using the seismic response of the 448 meter long Ghotour Bridge model, and compared with correlation and least square distance methods. Time frequency plans of damaged and non-damaged bridge matrix elements are calculated using reduced interference distribution. The difference matrix is calculated by subtraction of corresponding matrix elements. The possibility of an existing damage index is calculated by summation of all elements of difference matrices and then normalizing them with a maximum value. Linear time history analyses and earthquake acceleration records of San Fernando, Loma Prieta and Northridge earthquakes are used for seismic response analysis.

In previous response analyses of the Ghotour Bridge, as stated in reference [23], the third pier from the left is considered more vulnerable to seismic damage. Therefore, for the purpose of this study, a reduction of thirty percent in the stiffness of that pier is considered, to simulate the seismic damage in the damaged analytical model. It is shown that the proposed method could satisfactorily identify the damage location. For the seismic response of the top of the bridge piers, the maximum error in locating the damage is 6 percent, while, for the seismic response of the middle of the bridge piers, it is 14 percent.

The time-frequency representations used include: the short time Fourier transform spectrum, wavelet transform spectrum, Wigner-Ville Distribution, Choi-Williams distribution, smoothed pseudo Wigner-Ville distribution and reduced interference distribution, which are finally identified as optimal performance time-frequency representation for bridge seismic response signal processing. Reduced interference distribution and Wigner-Ville distribution are both in the Cohen class, but reduced interference distribution methods are more appropriate for processing seismic bridge transient nonstationary response signals. Time-frequency planes have been calculated and dynamic specifications of the system have been estimated.

The proposed algorithm is a seismic output-only method. Therefore, it has the advantage of not needing to define the bridge analytical model and measuring seismic input loading, and, also, not needing to use harmonic forced vibration analysis after earthquake occurrence for bridge seismic damage detection, as is general in some other methods.

Key Words: Bridge system identification, damage detection, time-frequency representation, modified matrix subtraction.

EXPERIMENTAL INVESTIGATION OF CYLINDRICAL PIER SHAPE EFFECT ON FLOW INDUCED BY DAM BREAK

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Abstract

Although dam failure rarely occurs, flooding caused by dam-break flow usually results in considerable property damage, as well as, in some cases, loss of life. Induced flow by a dam break occurrence is affected very much by natural and artificial obstacles, such as bridge piers,

in cement, which plays a main role in the properties of concrete. This complicated structure leads to a complexity in fracture processes. Considering this reason, most mechanical properties of concrete and studies on its behavior are based on experimental results. Since experiments require time and money, providing mathematical models to simulate the behavior of concrete is necessary.

In general, modeling fracture and damage within concrete, and other quasi-brittle materials, has been classified as either continuum or discrete approaches. Continuum models provide an average description of material behavior for a representative volume element. Because the width of the fracture process zone (FPZ) in concrete can be sizeable (roughly several times the maximum aggregate size), simulation of concrete fracture at mesoscale, with continuum approaches, is not suitable. Use of discrete micromechanical models is motivated by the need for fundamental knowledge, to improve material behavior. If the material structure (e.g at micro/meso scale of observation) is explicitly represented, the models provide a direct way for studying crack patterns; mechanisms of softening in post-peak branches and size effect/scaling phenomena.

In this paper, two-dimensional geometrical models for concrete are generated, taking the random distribution of aggregates at mesoscale into consideration. The generation procedure is based upon the Voronoi diagram method. The aggregate particles are constructed by several polygons and then placed into the concrete model, in such a way that there is no intersection between them. In this method, simulation of the fracture of aggregate in high strength concrete is feasible. The generated model can be used for modeling concrete with the discrete method. Finally, the model analyzed using the discrete element method.

Key Words: Concrete specimen, Voronoi diagram, aggregates, random distribution, connectivity matrix, discrete element method.

INVESTIGATING THE CONSOLIDATION BEHAVIOR OF CONTAMINATED CLAY

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Abstract

Soil is generally subjected to different contaminants that are being used and excreted into the environment. Leakage of these materials can influence its physical and mechanical characteristics. A review of technical literature in this field shows some contradictions between the results of different research, which reveals the impact of soil and contaminant type on the behavior of contaminated clayey soil. In order to investigate the effects of organic contamination on the physical and mechanical characteristics of clayey soil, in the present study, a series of index tests, besides one-dimensional consolidation (Oedometer tests), has been performed. Two types of clay, Kaolinite and Bentonite, with low and high plastic indexes are used as the base soils. Also kerosene and gasoil are applied as the organic contaminant in four different percentages of 0, 3, 6 and 9 to the base soil. All samples were kept for seven days in polyethylene bags to perform all chemical reactions before the tests. After that, water is used to saturate all samples normally within 48 hours. Results of physical tests reveal that Atterberg limits increase, by an increase in degree of contamination, for both considered soils. Also, maximum dry density increases with enhancement of the degree of contamination. However, according to the Proctor compaction tests, the optimum moisture content reduces with degree of contamination. This is illustrated due to the lubrication of grains during contamination with organic material. Consolidation tests are conducted on samples in two distinct relative compactions of 50% and 70%, and the results are investigated in e-Log (p) coordinates. Based on the results of one dimensional consolidation tests, compressibility coefficient increases, with an increase in contaminant percentage for both soils. Also, the effects of contamination on the consolidation behavior of clay increase with an enhancement in relative compaction. As a result, it is negligible in soil with low relative compaction. Using the results of tests, an empirical relation is suggested between the compressibility coefficient of contaminated soil and its relative compaction and liquid limit. Comparison of the suggested equation with ordinary relations in soil mechanics texts shows a great difference, which proves the necessity for new suggested forms in contaminated soil. Finally, it was concluded that chemical and organic contaminants, like kerosene and gas oil, which are not soluble in water, are more effective in changing the physical characteristics of soil, like Atterberg limits and relative compaction. However, compared to the first category, soluble organic contaminants are more effective on the mechanical and consolidation characteristics of clayey soil.

tities vary from 96% in total normalized energy to 3% in dissipation. Compared to the NoDealiasing scheme, modified DealiasXYZ reduces the computational time around 33%. Therefore, from a practical standpoint, the choice between the costly, ordinary, and de-aliased rotational form reduces to the last one, if the final decision rests on economics.

Key Words: Direct numerical simulation (DNS), τ pseudo spectral method, channel flow, aliasing errors, variable time-stepping algorithm.

EFFECT OF THE HETEROGENEITY OF UNDRAINED SHEAR STRENGTH ON THE STABILITY OF NATURAL SLOPES

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Abstract

Slope stability analysis is a geotechnical engineering problem characterized by many sources of uncertainty. Some of the uncertainties are related to the variability of soil properties involved in the analysis. The influence of spatial variation on the mean of the safety factor is discussed in both deterministic and stochastic numerical analysis contexts. A numerical procedure for a probabilistic slope stability analysis, based on Monte Carlo simulation, which considers the spatial variability of soil properties, is presented to assess the influence of randomly distributed undrained shear strength. In the proposed method, the commercially available finite difference numerical code, FLAC 5.0, is merged with random field theory generated using the Cholesky decomposition technique. For each realization, the random field of c_u is generated by Cholesky decomposition at the center of the element level, and the in-situ stresses in the slope are generated by applying gravity loading. This method considers the spatial variability of soil properties, and applies a strength reduction method to estimate the safety factor of a slope. Considering the case of a 5.0 m high cohesive soil slope of 54.5^0 (a range of coefficients of variation (COV) from 10% to 50% in cohesion values), parametric studies are performed to study the effect of stochastic soil cohesion on the statistics of the safety factor, in comparison to the deterministic solution available for the uniformly constant cohesion property. Effects of the statistical range of variability of c_u on the mean of the safety factor are also presented and give an important insight into their effect on reliability analyses. The results obtained in this study are useful to understand the role of cohesion variations in slope stability analysis under different slope conditions and material properties. The coefficient of variation of undrained shear strength was proven to have a significant effect on the reliability of safety factor calculations. The observations made from this study help to explain the requirement for slope stability calculations in a probabilistic framework. It is further demonstrated that the variability of soil properties translates into a substantial reduction in the safety factor (in an average sense), compared to the corresponding deterministic (homogeneous soil) case.

Key Words: Heterogeneity, random field, stochastic analysis, factor of safety, reliability index, Monte Carlo.

AUTOMATIC MESH GENERATION FOR CONCRETE SPECIMENS, WITH RANDOM DISTRIBUTION OF AGGREGATES AND SOLUTION WITH THE DISCRETE ELEMENT METHOD

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Abstract

Concrete is perhaps the most available manufactured material. The low cost, wide availability, ease of use and high durability of concrete has led to its continually increasing usage. It can be a hastily prepared, low-grade mixture for simple applications, or can be a firmly controlled, engineering material for high-performance structures. Complex physical and chemical interactions exist

Abstracts of Papers in English

ON THE EFFECT OF ALIASING ERRORS IN THE ROTATIONAL FORM FOR CHANNEL FLOW ANALYSIS IN DIRECT NUMERICAL SIMULATION

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Abstract
The objective of this work is to perform aliased and dealiased direct numerical simulation of a turbulent channel flow with a variable time-stepping algorithm. The time advancement is carried out by an implicit 3rd order backward different scheme for linear terms, and explicit forward Euler for nonlinear terms (SBDF3), in T=300s (about 12000 time step). A τ pseudo spectral method is employed on $128\times65\times128$ computational grids in $\Omega=[0.4\pi]\times[-1.1]\times[0.2\pi]$. The Fourier series in stream-wise and span-wise directions and Chebychev polynomial expansion in a normal direction are employed. The friction Reynolds number is Re_τ=175 and initial viscosity is set to ν=1/4000. The effect of aliasing errors is examined in the NoDealiasing scheme. Also, the product's aliasing errors are eliminated by truncating the Fourier coefficients of the velocity and the product, using the so-called "2/3 rule", in three schemes of: DealiasY ،DealiasXZ and DealiasXYZ. A comparison of turbulence intensities is made over the interval from $T_0 = 100$ to $T_1 = 300$. The results of turbulence statistics, wall-shear velocity, standard deviation, overall CPU time and total normalized energy of instantaneous velocities have also been collected. Also, the results of the mean velocity profile are compared to the scaling laws for viscous and inertial layers in all schemes. The present results of turbulence strength show significant discrepancies between the results of NoDealiasing and DealiasY schemes and the DealiasXZ and DealiasXYZ schemes at the other side. Alsom there are no considerable differences between DealiasXZ and DealiasXYZ results. The differences between computed values of turbulent quan-