Abstract

In this study, in order to determine the time and location of damage occurrence in moment-resisting frames, a method, based on a general concept of signal processing methods, is presented. Most previously presented methods aimed at finding the time and location of damage by considering occurrence changes in structural responses using Fourier, short time Fourier or wavelet transform methods. Vibration properties of the system may be addressed as the vibration modal frequencies or modal shapes of the structure. In the proposed method, wavelet analysis of more complex responses of the structure, i.e. rotational, angular velocity or acceleration responses of the joints (nodes of the frame), is employed to extract information about damage. These functions contain more information, such that wavelet analysis may be conducted based on only the first level of signal decomposition. To determine the location of damage, the concept of an amplitude spectrum is used, which is achieved from comparison of the amplitude spectra of the rotational responses of the two adjacent nodes. Since, by occurring damage, there is a large difference between these amplitude spectra, there is no doubt that the location of damage in this method will be found. In this research, there is no need to know the primary system properties, and this is the main advantage of the method. The other advantage is that the time of damage is achievable, because its time and location is directly computed from the measured earthquake responses; there is no need to conduct any (ambient or forced) vibration tests. Extensive analyses indicate the accuracy and power of the proposed method to successfully determine the time and location of damage during different loadings. According to the ability of this method to detect specifications of damage at early stages, it is recommended for the health monitoring of important structures, whose performances are strongly considered during and after strong ground motion earthquakes.

Key Words: damage detection, wavelet transform, signal processing, moment frame.

comparison of the analytical results obtained from the proposed method with those of previous research, it was concluded that the analytical procedure proposed reliably calculates active earth pressure due to surcharge in cohesive-frictional soil.
The variations of angle of failure wedge versus intensity of surcharge indicate that an increase in the intensity of the surcharge causes an increase in the angle of the failure wedge, but, a change in the distance of the surcharge from the wall does not affect the angle of the failure wedge significantly. Also, the results show that by an increase in the distance of the surcharge from the wall, lateral pressure decreases, and that moving the surcharge out of the failure wedge has no effect on active earth pressure. Comparisons show that the results from the suggested method are a lower bound for values obtained by recommended methods in ASHTOO (2007) and U.S Army Crops (2005) codes. The suggested method is also in good agreement with that of Motta (1994).

Key Words: Active earth pressure, horizontal slice method, retaining wall, surcharge.

MODIFIED ENERGY METHOD FOR EVALUATION OF STEEL MOMENT-RESISTING FRAME RESPONSE UNDER SEISMIC EXCITATION

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Abstract
From the viewpoint of building response to seismic ground motion, there are different seismic design methodologies. Currently, seismic design codes are based on the force method. However, the disadvantages of this method in neglecting important parameters, including structural vulnerability potential, as well as characteristics of strong motion, have caused the improper performance of structures in past catastrophic earthquakes. Thus, seismic design methodology shifted to nonlinear methods, based on performance concepts, and, consequently, new methods, based on displacement, have been proposed in recent years for better evaluation of structural performance. Due to inherent weaknesses, such as dependency accuracy to ground motion characteristics, incorporated in these design methods, it is expected that the energy method will advance and supersede current structural seismic design methods. Since the damage value of a structure caused by an earthquake is in a close relationship with the energy dissipation capacity of the structure, it can be anticipated that the energy based method will be a proper technique for evaluation of structural performance. In this study, the accuracy of the energy-based method in predicting the displacement demand of steel moment resisting frames of different storey numbers, under near-field and far-field earthquake records, is studied. To capture the accuracy of the energy-based method, the obtained results have been compared with the results of non-linear time-history analysis. Taking into account the amount of energy transformed from the ground to structures, which has directed the correlation to spectrum velocity, its characteristics for near and far-field records are studied first. A new method, which depends on spectrum intensity (SI), is proposed for more accurate prediction of the energy transferred from earthquake records to structures. Finally, by examining the accuracy of this method, it is observed that the proposed method can significantly increase the result accuracy for any type of seismic excitation in predicting the displacement demand of frames.

Key Words: seismic design, energy method, displacement demand, near-field record, far-field record, velocity spectrum.

A NEW WAVELET BASED-METHOD FOR DAMAGE DETECTION OF MOMENT-RESISTING FRAME STRUCTURES

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Abstract
High Performance Fiber Reinforced Cementitious Composites; HPFRCC, are cement matrices with strain hardening responses under tension loading. In these composites, the cement mortar with fine aggregates is reinforced by random distributed fibers and may be used for various applications, such as rehabilitation of structural members. In this paper, the mechanical properties of HPFRCC materials are reviewed briefly. Moreover, a one-bay and one-story reinforced concrete frame, which had been tested by Cranston, is selected and investigated, using high performance materials with different tensile and compressive strengths, instead of concrete, in the connection zone and the whole frame. Analytical results show that using HPFRCC material instead of regular concrete increases the ductility and loading capacity of the frame. In this investigation, by increasing the amount of compressive and tensile strength of HPFRCC, the loading capacity of the composite frames increased about 40% compared to the RC frame. Ductility factors of these composite frames also increased about 50% and 70% compared to the RC frame, respectively. The cracking patterns of these frames are compared to each other. Cranston's experimental investigation was undertaken to corroborate the analytical work and lend further insight into the nature of finite element items in the frame structure. The structural properties of normal concrete are constant during this investigation, but the structural properties of HPFRCC are variable, including different compressive and tensile strengths. Compressive strengths of HPFRCC are 28, 35 and 39 MPa, and tensile strengths are 3, 4 and 5 Mpa. Lateral load-deflection curves and cracking patterns of the RC (full reinforced concrete frame), RH (full reinforced HPFRCC frame) and RCH (reinforced concrete frame with HPFRCC material in its connections) frames with $\varepsilon_{tu} = 1\%$ are investigated. Analytical results show that maximum ductility occurs in the RCH frame with compressive and tensile strengths of 28 and 5 MPa, respectively. The maximum amount of ultimate lateral load occurs in the RH frame with compressive and tensile strengths of 28 and 5 MPa, respectively. The maximum amount of ultimate lateral displacement occurs in the RH frame with compressive and tensile strengths of 35 and 3 MPa, respectively. This improvement in the lateral behavior of frames with HPFRCC materials is concluded from the large ultimate tensile strain of the HPFRCC material, which is altered instead of normal concrete with low $\varepsilon_{tu} = 1\%$ and, consequently, increases both the load and deflection capacity of the structure. In addition, another factor that has an important role to play in the ascending trend of the mentioned curves is steel reinforcements. When concrete is altered by HPFRCC, because of the higher $\varepsilon_{tu} = 1\%$ of HPFRCC, steel rebars can reach a closer amount of the plastic strain value of steel and, hence, lateral deflection and force increase simultaneously. In the other word, the main role of HPFRCC is to assist the work of steel by keeping the unity of the HPFRCC and steel as a composite material by forming multiple cracking and avoiding a concentrated failure plane. It can be used in critical parts of reinforced concrete frames to increase the capacity of the structure.

Key Words: HPFRCC, reinforced concrete, frame, ductility, cracking.

ANALYTICAL CALCULATION FOR EFFECT OF SURCHARGE ON ACTIVE EARTH PRESSURE OF RETAINING WALLS

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Abstract
The use of retaining walls is one of the most common approaches for construction of retaining soil structures around the world. These walls have remarkable flexibility against earthquake loads and are less sensitive to settlement. In many retaining wall problems, it is necessary to determine the additional earth pressure produced by surcharge loads acting on the soil surface behind the wall. Considering the application of various surcharge loads on the backfill in such systems, the necessity has been felt, over recent decades, to find an appropriate method for calculating the effect of surcharge on active earth pressure in retaining walls.
In this study, based on analytical methods, previous formulations of horizontal slices methods are improved, and a new formulation has been proposed for estimating the effect of surcharge on the active earth pressure of retaining walls with a cohesive-frictional backfill. Using a

foundations resting adjacent to the top of a slope, evaluated by the stress characteristic method. It is shown that all seismic bearing capacity factors reduce considerably with an increase in either ground inclination or in $\mathbf{k_h}$. It is also shown that in weighty media, the seismic bearing capacity of a foundation adjacent to the top of a slope is less compared to the one resting on a similar infinite slope, whereas, in weight-less media, it is equal. The values of the seismic bearing capacity factors calculated by the stress characteristic method are compared with those obtained by the upper bound theorem reported in the literature. It is observed that the stress characteristic method gives lower values of seismic bearing capacity factors than those estimated by the upper bound theorem.

Key Words: Seismic bearing capacity, rigid strip foundation, stress characteristic method, slope.

IMPROVED GENETIC CODING FOR ACCELEROGRAM SET OPTIMIZATION

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Abstract
Time-history earthquake records are critical means for many earthquake engineering applications, including step-by-step numerical solution of dynamic, nonlinear or highly damped systems, seismic design of new buildings and infrastructures, seismic control, risk assessment and vulnerability evaluation of existing structures, and so on. They are provided using statistical simulated records, geological model-based artificial earthquakes or recorded accelerograms of real experienced earthquakes. The latter is preferred in many cases, due to expensive computational effort and lack of reliability in simulating events of strong ground motion using artificial methods. However, the resulted structural responses are highly sensitive to the selected earthquake record, so that their variation from one record to another is a major source of uncertainty in further design and decision making. In order to overcome such a challenge, well-known seismic design regulations have been accepted using a set of earthquake records instead of one, provided they are scaled to match a target design spectrum. It is especially beneficial in the absence of sufficient site-specific earthquake records or the impossibility of their extraction via seismic hazard analyses. As no further limitation than over-riding the design spectra is implied, the resulted mean spectrum may over-estimate the target, leading to an economically undesired design. In addition, the corresponding scale factors will not be unique for a set of records unless taken as similar or optimized by proper methods. Hence, it is reasonable to select a set of accelerograms from an available catalogue that is optimally compatible with the design spectrum; formulated as the first optimization problem in the present work. While the set of optimal records is identified, their scaling factors are also optimized as the second problem formulation. The present work employs genetic algorithm as a reliable meta-heuristic, and utilizes its operators to solve both optimization problems. In addition to conventional binary coding, an integer index coding is also utilized for the special case of optimization problems in this research. The superiority of the integer coding over the binary type is not only discussed in reducing search space cardinality, but is also shown via the results of a numerical example, using a list of 136 earthquake records, to match the target spectra, according to the Iranian Standard of Practice; No.2800. The results also show the proposed method is highly beneficial in matching the target design spectrum, with respect to common practice, with a trial-selected, uniform-coefficient set of records.

Key Words: Accelerogram selection, optimization, genetic algorithm, coding.

USING HPFRCC FOR INCREASING THE CAPACITY OF A R.C. FRAME

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Abstract

Piles have been used for many years as a type of structural foundation. The design of pile foundations and estimation of static pile bearing capacities, based on measured soil properties, have been improved considerably over the years. However, due to inherent soil uncertainities and disturbances, there is always an element of uncertainty about the design capacity. Therefore, most theoretical approaches have been mainly based on simplifications and assumptions. The cone penetration test (CPT) is considered as one of the most useful in situ tests for the characterization of soil. Due to the similarity between the cone and the pile, determination of the pile capacity from CPT data is among its earliest applications. The measured cone resistance (q_c) and sleeve friction (f_s) usually are employed for estimation of the pile Tip and shaft resistances, respectively. Over the last few years or so, the use of artificial neural networks (ANNs) has increased in many areas of engineering. In particular, ANNs have been applied to many geotechnical engineering problems and have demonstrated some degree of success. Group method of data handling (GMDH) type neural networks optimized using genetic algorithms (GAs), are used to model the effects of effective cone Tip resistance (q_E) and cone sleeve friction (f_s) as input parameters on pile Tip resistance, by applying some experimentally obtained training and test data. 29 pile case histories have been compiled, including static and dynamic loading tests, performed at sites, including CPT sounding. The pile embedment lengths range from 9 m through 31 m. The pile Tip resistances range from 0.4 MPa through 29.4 MPa. A sensitivity analysis of the obtained model has been carried out to study the influence of input parameters on model output. According to the sensitivity analysis results, the pile Tip resistance (r_t) is considerably influenced by the effective cone Tip resistance (q_E), and the value rises by increasing qE values. Also, for a constant value of effective cone Tip resistance (q_E), by decreasing the cone sleeve friction (f_s), the pile Tip resistance increases. Pile toe capacities calculated by the proposed method are compared Tip capacities calculated by five other direct methods. The proposed method gives values that are more consistent and closer to measured ones than current methods. The results demonstrate that the proposed method gives values that are consistent and close to the measured ones.

Key Words: Pile bearing capacity, cone penetration test, artificial neural networks.

Estimation of Seismic Bearing Capacity Coefficients of Strip Foundations Adjacent to the Top of Slopes by the Stress Characteristic Method

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Abstract

Structures, such as buildings, walls and towers, are often located on sloping ground, which may involve the construction of shallow foundations adjacent to the top of the slope. The literature concerned with evaluation of the bearing capacity factors of foundations is mostly limited to horizontal ground surfaces, as well as static cases. Assessment of the seismic bearing capacity of strip foundations has been the concern of few researchers in the field of geotechnical earthquake engineering during recent decades. This paper presents the seismic bearing capacity factors, $\mathbf{N}_\gamma$, $\mathbf{N_q}$ and $\mathbf{N_c}$, of a rigid strip foundation resting adjacent to the top of a slope, obtained by the stress characteristic method, commonly referred to as the slip-line method.

The effects of earthquakes on body forces, as well as on overburdened surcharges are incorporated. It is assumed that the soil behaves as rigid perfectly plastic and obeys the well known Mohr-Coulomb failure criteria under plane strain conditions. It is assumed that the state of stress everywhere in the neighborhood of the foundation is at failure. It is also assumed that everywhere along the surface of the foundation, the ratio of shear to normal stress is equal to the horizontal earthquake acceleration coefficient ($\mathbf{k_h}$). The $\mathbf{N}_\gamma$ parameter was calculated based on the both-sides failure mechanism, whereas the $\mathbf{N_q}$ and $\mathbf{N_c}$ parameters were calculated based on the single-side failure mechanism. The $\mathbf{N_c}$ parameter for cohesive media was calculated using the rule of equivalent states.

Some graphs and tables are presented that could be used in order to assess the seismic bearing capacity factors of

under dynamic loading with the finite difference method using FLAC, have been investigated. The findings indicate rather positive results with each parameter.

Key Words: Geosynthetic Reinforced Soil Retaining Walls (GRSRW), dynamic analysis, pseudo-static analysis, earthquake equivalent horizontal acceleration coefficient.

RISK ALLOCATION OPTIMIZATION IN A CONSTRUCTION PROJECT USING THE ANT COLONY ALGORITHM

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Abstract

In order to transfer risks to the most capable party and provide a basis for project profit sharing, risk allocation has a strong influence on the time and cost of construction projects. In this paper, for the first time, allocation of risk to the most deserving party is defined as an optimization problem, and a quantitative model for risk allocation optimization is introduced. Since the aim of risk allocation is defined as achieving project objectives with maximum reliability and minimum cost, in the proposed model, an applicable and logical decision parameter is introduced and an optimization algorithm, based on the Ant Colony Optimization (ACO) method, is developed. The proposed model also provides a useful decision tool for the project owner to select the best insurance package by including a sensitivity analysis.
In order to design the ACO optimization algorithm of the risk allocation optimization model; initially, the objectives of owners within the allocation process are identified and the objective function is defined. With respect to the objective function, the risk allocation problem is then restructured as an optimization problem, and the decision parameters, constraints and a flowchart of the model structure are defined. These parameters and constraints are formulated in a mathematical equation; and an optimization algorithm is designed based on Ant Colony Optimization (ACO).
By receiving “profit requested for risk bearing by each participant” as input, the proposed model calculates the cost of risk management for the owner and then minimizes the objective function in an Ant Colony Optimization algorithm. Two constraints are defined and formulated in the proposed model, in order to simulate the real decision process of risk allocation. As follows: 1) the maximum financial credit of each party to compensate the consequence of any risk and 2) the financial ability of the owner to ensure against risk events. Varying this constraint, sensitivity analysis would be available in the model to optimize the guarantee package for the owner. Therefore, this model could guide the decision maker towards addressing the most effective guarantees to the best party.
This model is applied in a case study to present its capability and usefulness. According to the findings of the applied proposed model, it could be concluded that risk sharing in a project should be done based on party competency and willingness. It is also concluded that the owner should participate in the risk allocation process if he/she wishes to achieve the best reliability in project objectives with minimum cost.

Key Words: Risk Allocation, risk management, optimization, ant colony optimization.

ESTIMATION OF THE TIP BEARING CAPACITY OF SINGLE PILE FROM CPTU DATA USING GMDH TYPE NEURAL NETWORKS

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Abstract

For many years, providing sufficient strength for buildings, whilst trying to prevent collapse, was the most important purpose behind seismic codes. After the Northridge earthquake (1994) and the amount of damage due to brittle behavior in steel structure connections, many studies about degrading effects have been undertaken. One of the most important degrading behaviors was in-cycle strength degradation. In recent years, many researchers have focused on in-cycle strength degradation in hysteresis cycles. In this phenomenon, degradation occurs in the same cycle of loading. Recent investigations done by FEMA-P440A, have shown that the effects of in-cycle strength degradation can be critical in determining the possibility of lateral dynamic instability in Single Degree Of Freedom (SDOF) systems. Multi degree of freedom (MDOF) systems have more complicated behavior than SDOF systems. In this research, in order to study the effects of such kinds of degradation, 3, 5 and 7 story steel moment frame buildings with three types of connection (Pre-Northridge, Post-Northridge and Elastic-Perfectly-Plastic), have been modeled. In order to have a more precise study, a probabilistic seismic design approach has been used and, then, the reliability of structures at pre-defined confidence levels have been calculated, By performing Incremental Dynamic Analysis (IDA), the required parameters in the probabilistic approach, such as demand and capacity, have been calculated. Results of this study have shown that in-cycle strength degradation can greatly increase the likelihood of global dynamic instability and decrease the reliability of mid-rise steel moment frame structures.

Key Words: In-cycle strength degradation, incremental dynamic analysis, steel moment frame, pre-Northridge connection, probabilistic approach.

EVALUATION OF THE DYNAMIC BEHAVIOR OF GEOSYNTHETIC REINFORCED SOIL RETAINING WALLS TO PRESENT THE EARTHQUAKE EQUIVALENT HORIZONTAL ACCELERATION COEFFICIENT FOR THE MODEL

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Abstract

Geosynthetics have been proved suitable for reinforced soil retaining walls. Due to an increase in the use of geosynthetic reinforced soil systems in seismic active zones that bear frequent earthquakes, it is important to study the dynamic behavior of these structures. Hence, in this research, a study on the seismic behavior of Geosynthetic Reinforced Soil Retaining Walls (GRSRW) has been undertaken to present the earthquake equivalent horizontal acceleration coefficient for the model.
As long as no force is imposed on the reinforcement, the existence of reinforcement in the soil retaining wall has no effect, hence, using reinforcement is useful only when the applied forces cause reinforcement tension, and the mobilized tension force can overcome the soil tension weakness. Thus, predicting mobilized forces in geosynthetics during an earthquake is very important.
The pseudo-static method is a suitable and simple approach to substitute for dynamic analyses of slope stability. Therefore, this research endeavors to offer an equivalent pseudo-static coefficient using a similar approach for the reinforced soil retaining walls to equalize dynamic behavior. A fundamental requirement to assess conservatism in current design practice and to validate new design approaches is a reliable estimate of the load in reinforcement layers to maintain the stability of the reinforced structure. Based on considering forces in reinforcements (as the most important factor of stability), the earthquake equivalent horizontal acceleration coefficient is proposed. Comprehensive sensitivity analyses have been performed to study the effects of parameters on forces and displacements. The effects of the most important parameters, such as wall height, maximum acceleration, vertical spacing of reinforcements, types of reinforcement and soils, through numerical modeling of geosynthetic reinforced soil retaining walls (GRSRW)

severe damage than structures located outside this zone. The near-fault of an earthquake can be defined as the area in the close vicinity of the fault rupture surface. Besides strong shaking, the characteristics of near-fault ground motion are linked to the fault geometry and the orientation of the travelling seismic. Vertical strike-slip faults can produce a directivity effect, and dip-slip faults can produce directivity effects, as well as hanging wall effects.
Although experimental tests of RC members provide valuable information about their behavior, these are normally expensive, time-consuming and require considerable human and physical resources. By using dynamic nonlinear finite element analysis, it is possible, at comparatively lower cost and effort, to predict the response of RC structures and members: e.g. plastic hinge length. Using the wealth of recent ground motion data, in the present paper, 462 inelastic time-history analyses have been performed to predict the nonlinear behavior of RC columns under near-fault earthquakes having a fling step. The effects of axial load and height over depth ratio, as well as the different characteristics of earthquakes, are evaluated by finite element methods and results are compared with corresponding experimental data.
Analytical models for columns analyzed under high axial loads exhibit longer plastic hinges than those analyzed under low axial loads. Based on the results, a simple expression is proposed that can be used to estimate the plastic hinge length of RC columns subjected to earthquakes. The results also show that potential l_p specified by ICC is not satisfactory for columns supporting high axial loads, and can even be non-conservative in some cases. It is suggested that the length of the region, in which closely-spaced ties are used, should be increased from 1.0h to 1.5h from the joint face.

Key Words: Plastic hinge length; near-fault ground motions; fling step; nonlinear behaviour; dynamic analysis.

NUMERICAL INVESTIGATION OF CIRCULAR FOUNDATION SIZE EFFECT ON CALCULATION OF AVERAGE COEFFICIENT OF SUBGRADE REACTION

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Abstract
The "Coefficient of Subgrade Reaction" was introduced in the form of a "Set of Springs" model by Winkler during the 19th century. In this model, the subgrade is modeled as a set of springs with a stiffness of k_s per unit area of the foundation carrying the structural load. In other words, the "Contact Pressure to Settlement" ratio for every point located in the contact zone of soil and foundation is called the "Coefficient of Subgrade Reaction", or k_s. This ratio explains the interaction of soil and foundation, and it can be used for calculation of shear and moment distributions in the foundation.
The model has been used by structural designers for decades, who have improved it to calculate stresses under flexible foundations, like continuous footings or raft foundations, as well as concrete pavements subjected to wheel loads. Therefore, proper estimation of k_s for raft foundations is essential for structural engineers. A commonly used method for in situ direct measurement of k_s is the Plate Load Test (PLT). As the PLT is carried out on a small scale, the influence zone is small. The results cannot then be used directly for large scale calculations. Among the commonly used equations for correlating the PLT results to k_s for large raft foundations are those proposed by Terzaghi (1955).
The main objective of this paper is investigating k_s for cemented granular materials using a numerical model. The results of three plate load tests are used for verification purposes, and calibrating the FEM numerical model used for predictions. The effects of the change of foundation size and thickness on the value of k_s are briefly discussed.
The results indicate that the Terzaghi (1955) equation for "Clay" estimates an acceptable value for k_s in cemented granular soils similar to Tehran alluvium.

Key Words: Coefficient of subgrade reaction, cemented granular soils, foundation size, plate load test.

PROBABILISTIC ASSESSMENT OF THE EFFECT OF IN-CYCLE STRENGTH DEGRADATION ON SEISMIC BEHAVIOR ON MID-RISE STEEL MOMENT FRAMES

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the quarter point of the bridge span. Despite other models, the aforementioned modeling strategy could yield a similar collapse mechanism to that of the prototype, and the ultimate failure load is achieved with only 1.3 percent error, in respect to the experimental one.

Key Words: stone arch bridge model, interface element, failure load.

STUDY AND MODELING OF HYDROMECHANICAL EFFECTS ON THE BISOTUN EPIGRAPH DAMAGING PROCESS

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Abstract
The 2500 to 2600 year old bisotun epigraph is one of the most important traditional monuments of the Hakhamaneshi period, which is located 30km from Kermanshah. This epigraph has been subjected to various damaging factors, such as surface erosion due to water flow, ground water dissolution, weathering and rock block instability. Regarding the important role of water flow in creating damage, the hydromechanical effects on the bisotun epigraph have been studied in this paper. Rock mass hydromechanical coupling behavior depends on various parameters; stress conditions, rock modulus of elasticity, joint shear and normal stiffness and joint dilation, which are at the center of this study .According to the results of this study, heterogeneity is one of the most significant factors in the hydraulic and mechanical properties of rock mass. Fracture density, mechanical properties and stress conditions are also significant factors.
One of the subjects studied and discussed in this paper is the best method of lessening fractures and cracks around the epigraph. According to investigations, the best method of improving fractures is injection. In this regard, hydromechanical coupling behavior related to borehole injection is studied. According to the importance and historical value of this epigraph, injection into the rock mass around the epigraph must be done with high quality and accuracy. One of the most important injection factors in this project is pressure, which must be fully under control, and whose value must be evaluated by numerical analysis, because high injection pressure will cause serious damage to this historical epigraph. In this regard hydromechanical behavior due to injection is studied in this paper, and the specifications and limitations of injection pressure are evaluated. A basic discussion evaluated in this paper is the control of injection pressure in such a range as to prevent hydraulic fracturing, and, in the last part of the paper, we have tried to study and evaluate hydromechanical behavior due to injection, such that hydraulic fracturing does not occur.

Key Words: Instability, hydromechanics, stress, dilation, shear stiffness, normal stiffness, heterogeneity, fracture density, mechanical properties, hydraulic fracturing.

A PROPOSED EQUATION FOR ESTIMATION OF THE PLASTIC HINGE LENGTH OF RC COLUMNS SUBJECTED TO NEAR-FAULT GROUND MOTIONS, HAVING FLING STEP

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Abstract
In a strong earthquake, a standard reinforced concrete column may develop plastic deformations in regions often termed; plastic hinge regions. The formation of a plastic hinge in an RC column; in regions that experience inelastic action; depends on the characteristics of the earthquake; as well as column details.
Recent earthquakes in Turkey (1999), Taiwan (1999), India (2001), Iran (2003), China (2008) and Japan (2011) have caused considerable loss of life and extensive damage to structures. The damage observed during the recent earthquakes proved the engineer's hypothesis that structures located within the near-fault area suffer more

Abstracts of Papers in English

DETERMINATION OF ULTIMATE FAILURE LOAD OF STONE ARCH BRIDGES USING CONSISTENT MATERIAL MODELS

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Abstract
In recent years, great interest has been shown towards the effective modeling of masonry arch bridges. However, the issue of an efficient model is a controversy among researchers with contrasting strategies. The fact that there are a great number of stone arch bridges in Iran (about 3300), most of which serve the railway network, makes the issue very crucial in terms of road network vulnerability, due to their unknown behavior against usual and unusual loads. In this paper, a nonlinear 3D finite element method is employed in order to determine the ultimate failure load of stone arch bridges. Most of these bridges are composed of three structural parts; arch barrel, backfill and spandrel walls. However, because of simplification in modeling masonry arch bridges in some research, spandrel walls are neglected. An efficient description of the material properties of these parts has great influence on the accuracy of the resulting ultimate failure load. Experience has shown that the elastic modeling of these systems could not yield a reasonable behavior. Also, even if only nonlinear models of different contacts are used, in some cases, the analysis results would not be satisfactory. It is understood that accurate results could be achieved even by simple Mohr-Coulomb models for the barrel arch and spandrel walls. At the same time, the Drucker-Prager material law for the backfill, along with appropriate modeling of the contact surfaces of different materials, should be used. It is shown that hardening stiffness in the pressure overclosure of hard contacts should not be neglected. In addition, the important role of spandrel walls has to be accounted for in a 3D analysis model. Indeed, the former improves the bridge's failure mechanism, whereas the latter restrains the bridge's lateral deformations. To validate the proposed model, an actual failure test on the Prestwood Bridge is considered. According to the actual failure test, the proposed model is subjected to a load at