cause serious damage. Hence, it is necessary to recognize the dynamic behavior of materials by conducting dynamic tests on cored materials and comparing the results with those of reconstituted specimen.
In this research, the dynamic behavior of soil in small strains was studied by performing a resonant column test on cored and reconstituted samples. The core sample used in this study is clayey sand with high plasticity and the reconstitution of samples was carried out using the moist tamping method. Then, core sample in the dry condition and reconstituted samples in dry and moist conditions were subjected to resonant column test according to the ASTMD4015 standard under isotropic and anisotropic consolidated stresses of 150, 300, 500 and 700 KPa. The effects of consolidation stress, reconstitution, moisture, and anisotropic consolidated stress condition were studied by using the shear modulus and damping ratio versus shear strain diagrams. Furthermore, the damping ratio of the samples was determined by both free vibration decay and half power bandwidth method and the effect of calculation method was studied as well. The results of the study indicated that by increasing the consolidation stress, the shear modulus and damping ratio increased and decreased, respectively. Also, reconstituting reduced the shear modulus, but the variation of damping ratio versus shear strain for cored and reconstituted samples was negligible. Comparison of diagrams in dry and moist reconstituted samples showed that moisture could significantly reduce the shear modulus, but did not affect the damping ratio. Anisotropic condition might also cause increase in shear modulus. The damping ratio calculated from the half power bandwidth method was more than that obtained from free vibration decay in all samples.

Key Words: Shear modulus, damping ratio, resonant column, core barrel sample, reconstituted sample.

PUBLIC PRIVATE COLLABORATION MODEL IN IRAN'S FREEWAY BOT PROJECTS (CASE STUDY)

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Abstract

Optimal collaboration of the partners in a project is identified as one of its success factors. Presentation of the theory/the model of the optimal collaboration in the private sector with the public sector in Iran's freeway projects is the main concern of this research. In this study, while trying to scrutinize the concept of collaboration and identify the various dimensions of this phenomenon, the factors contributing to the optimal collaboration and its outcomes will be investigated. To this end, the case study research method is used to collect data and the grounded theory is utilized to analyze data. After analyzing the data, by selecting an appropriate model, the main categories associated with the phenomenon are identified. In this research, private sector investment in BOT projects was considered. Therefore, a critical review of the research literature was carried out at the first step. Then, by referring to a partnership with different actors, different levels of responsibility are interviewed from both public and private sectors. Then, the data from the speech, the behavior and cooperation of the parties to the partnership are gathered at the meetings of the committee of the investment companies. In the following, the data are analyzed and the theoretical model of collaboration is presented. According to the obtained results of this research, the capability of the private sector, capital security, stakeholder engagement, contract, government managers' competence, risk sharing, and joint decision-making are identified as the factors affecting the optimal collaboration. Besides, the completion of the project with the appropriate cost, time and quality, the achievement of the public sector benefits, the private sector financial profit, the satisfaction of the private sector, and the promotion of the public sector's belief in engagement with the private sector as the result of optimal collaboration between the parties are identified.

Key Words: PPP, collaboration, BOT, Iran freeway industry.

REMOLDING EFFECT ON DYNAMIC BEHAVIOR OF SANDY SOIL SAMPLES USING RESONANT COLUMN TESTS

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Abstract

Shear modulus and damping ratio are two most important dynamic parameters for seismic design of structures. Several attempts have been made to determine and study these two dynamic parameters using field and laboratory experiments. Sample disturbance is one of the reasons for the discrepancy between laboratory and in situ dynamic parameter test results. Failure to heed the effects of reconstituting on the dynamic parameters of soil under dynamic laboratory tests and analysis may

the structures are exposed to major threats due to decrease in their efficiency and also, unpredictable loads. These problems are aggravated by induced loads due to natural or artificial dangers such as earthquakes and explosions. The main objective of this paper is to investigate the free vibration of cylindrical shell structures with functionally graded materials, FGM, on the elastic foundation in undamaged and damaged conditions. Functionally graded materials are a new type of composite materials and are characterized by gradual variations in composition, resulting in desired changes of the characteristics of the material in different directions. For this purpose, an analytical method based on first-order shear deformation theory is used. The corresponding equations which are extracted through the Maclaurin series are implemented using the MAPLE software and the corresponding frequencies and modal shapes are obtained. The numerical verification of the model is carried out by comparing the results with those of other researches in the literature and also with the results of modeling in ABAQUS software. The comparisons show good agreement between these results, indicating the accuracy and applicability of the applied numerical method. In order to investigate the effectiveness of the proposed method in identification of the damaged location in the structure, different single and multiple damage scenarios are applied to the structure resting an elastic base condition, considering various supporting conditions such as clamped and simply supports. The corresponding damage scenarios are applied through a reduction in the elasticity modulus of the interested cylindrical layers materials. In the damage identification process, modal shape derivatives are used. The results show the efficiency of the proposed model in detecting the damaged zone of the structure. The proposed method is capable of expanding real structures.

Key Words: Functionally graded materials (FGM), cylindrical shell, damage identification, first-order shear deformation theory, modal derivatives shapes.

INVESTIGATION AND COMPARISON OF THE PROPERTIES OF CEMENT-BACED MIXTURES CONTAINING DIFFERENT TYPE OF POLYMERS

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Abstract

In this research the effects of three types of commercial polymers including Styrene-butadiene-rubber, Ethylene-vinyl acetate and Styrene-acrylic on the properties of cement mixtures have been investigated. Polymer contents in the test mortar mixtures were 5, 10, 15 and 20% by weight of cement and the water-cement ratio was kept constant at 0.33. In order to investigate and compare the influences of polymer materials on the mortar specifications the mechanical properties including compressive strength, flexural toughness and durability properties including rapid chloride migration coefficient and the amount of capillary and volumetric absorption, resistance to sulfuric acid were evaluated. The specimens were cured under wet conditions at early ages (7 days) and air cured at later ages (After 7 days until the test). The results indicate an improvement in several mechanical characteristics such as flexural toughness and significant influence on reducing the adsorption rates of cement mixtures in the rapid chloride migration coefficient, water absorption and resistance to sulfuric acid. Comparing the results at different ages showed that dry curing period has had a significant effect on the strength growth process and mechanical properties of polymer modified mortars. According to the results of mechanical tests, the Styrene-acrylic and Ethylene-vinyl acetate provided significant improvements in the flexural toughness and this improvement was enhanced by increasing the polymer-cement ratio. Concerning the penetration and adsorption of water in the mortars by same polymer-cement ratio, Styrene-acrylic modified mortars have obtained higher enhancements than other compounds. Also, in the ratio of 15% polymer to cement, the lowest amount of water absorption and penetration was observed in the Styrene- acrylic modified mortars which showed the optimal ratio. According to the results of the sulfuric acid test, the best practice was for the Ethylene-vinyl acetate modified mortars. The results of this study indicate that modified polymeric cementitious base mixtures can be widely used in construction industry applications.

Key Words: Mechanical properties, durability, styrene-butadiene-rubber, ethylene-vinyl acetate, styrene-acrylic.

Kalman Filter as an effective estimator and Robbins-Monroe stochastic approximation technique as the parameters noise covariance matrix regulator. The abovementioned method was applied to two one-story and one three-story shear buildings and the results of the identification process were presented with emphasis on the effects of measurement noise, modeling error, and use of the Monte-Carlo random simulation method. Simulation results demonstrated the accuracy and efficiency of the proposed method in online jointly estimation applications as well as the desirable capability to track hysteretic curves of each structural floor.

Key Words: Online health monitoring, nonlinear hysteretic, stiffness and strength degradation, pinching effect, unscented kalman filter, robbins-monro stochastic approximation technique.

INVESTIGATION OF THE EFFECT OF STEEL FIBERS ON FAILURE EXTENSION OF RECYCLED AGGREGATE CONCRETE BEAMS WITH LAP-SPLICED BARS

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Abstract
In this research, the effect of adding 0% and 2% volumetric percents of steel fibers in beams containing three patches (43 cm, 34 cm, and 26 cm in length) and recycled aggregate 0 and 100% on the cracking and expansion path. The cracks were examined under static loading. The purpose of this study is to reduce the minimum crack width for adding steel fibers to reinforced concrete beams made of recycled aggregates and tensile reinforcement patches. Hence, twelve specimens of the beam were made at 150, 200, 1500 mm lengths with a length of different tensile adherence rates and different percentages of steel and recycled aggregates. The experiments were performed as a quadrilateral bend. In experiments, the load-displacement curve in the middle of the span of the specimens, the trajectory expansion along the beam and at the maximum flexural anchor, the width of cracking, and the effect of adding steel fibers on the compression and elongation of the specimens were indirectly investigated. In addition, the results were compared with those presented in the ACI, CSA, NS, CEB FIP, and EuroCode2 regulations. The results of the experiments showed that the addition of steel fibers reduced the slip of the tensile reinforcement in the patched area and decreased the crack-cracking width. Also, with addition of steel fibers in beams made of 2% recycled aggregate, the patch length can be reduced by 40%.

Key Words: Fibers concrete, static loading, failure crack, lap-spliced bars, recycled aggregate.

DAMAGE IDENTIFICATION IN CYLINDRICAL SHELLS WITH FUNCTIONALLY GRADED MATERIALS RESTING ON ELASTIC FOUNDATION

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Abstract
Identification of damage location in a structure is an important issue in structural health monitoring. Most of

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Abstract

In this study, the effect of initial principal stress rotation on anisotropic behavior of medium dense Firoozkuh sand in the drained condition was studied. Hollow Cylindrical Apparatus (HCA) was used to conduct the tests in the drained condition on the medium dense specimens of Firoozkuh sand. All specimens were prepared with a height of 200 mm and outer and inner diameters of 100 and 60 mm, respectively, using dry air pluviation method. The specimens were consolidated subjected to the anisotropic initial stresses with different directions (α_c). During consolidation, stress ratio($R_c = \sigma'_{1c}/\sigma'_{3c} =$ 2)was maintained equal to 2. Specimens were consolidated under an anisotropic condition in which the rotation of initial principal stresses was set to a constant value varying from zero to 45^0. The specimens were sheared under different inclinations of principal stress increments($\alpha_{\delta\sigma}$) varying from zero to45^0 . In these tests, the direction of principal stress increments($\alpha_{\delta\sigma}$) may be not equal to the direction of the principal stress due to anisotropic stresses, applied in the consolidation phase. Generally, the results showed a decrease in the shear strength of sand by increasing ($\alpha_{\delta\sigma}$). The results showed that the stress-strain behavior and shear strength of medium dense sand were influenced by the inclination of initial principal stresses. Initial anisotropic principal stresses caused initial shear strains which softened the stress-strain behavior of sand. Therefore, the shear modulus and shear strength for anisotropic consolidated specimens were less than that of the isotropic consolidated specimens. The anisotropic response of medium dense sands was observed to be governed by(α_c) . It was found that the shear modulus and shear strength of sand relatively decreased and anisotropy coefficient significantly increased when anisotropic initial stress and increments of principal stresses were in the same direction. The effect of initial stress state on the shear modulus was more noticeable than that on the shear strength of sand.

Key Words: Anisotropic behavior of sand, initial principal stress rotation, hollow cylindrical apparatus (HCA), firoozkuh sand.

ONLINE HEALTH MONITORING OF DETERIORATING NONLINEAR HYSTERETIC STRUCTURES USING UNSCENTED KALMAN FILTER (UKF)

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Abstract

Rapid assessment of structural safety and performance following the occurrence of important events such as moderate to severe earthquakes is so significant and vital and reveals the need for developing online and pseudo-online health monitoring methods. Online monitoring methods can be implemented without the need for in-situ testing and expert staff to analyze the recorded data. In other words, these methods provide comprehensive information on the condition of the structure only by using the vibration data recorded by embedded sensors as well as the preset health monitoring algorithms. On the other hand, most civil structures exhibit a nonlinear response after severe incidents like earthquakes. In many cases, this nonlinear hysteretic behavior is along with stiffness deterioration, strength degradation, pinching effect, permanent plastic deformation, or a combination of them. Therefore, considering a comprehensive definition of damage that takes into account the nonlinear behavior of structures according to their type is one of the most important steps in the process of structural identification and evaluation. Various methods have been introduced in the literature for online estimation of states and parameters of nonlinear structures. However, the challenging part in most of these methods is the determination of parameters noise covariance matrix which becomes particularly important due to the increasing number of structural floors, thus increasing the number of unknown parameters. In this study, an effective method for online jointly estimation of state and parameters of nonlinear hysteretic structures with consideration of degradation and pinching phenomena is proposed. Simultaneous estimation of states and parameters is conducted using a combination of Unscented

The length of the fibers was 25 mm. The mechanical tests performed consist of compressive strength, flexural strength, tensile strength, flexural toughness and impact strength, and RCMT as well as the shrinkage test. The compressive strength test was performed at the ages of 1, 7, 28 and 90 days. The mixtures made of calcium aluminate cement had higher compressive strength due to faster formation of microstructure than the Portland cement mixtures so that 90 -day compressive strength of Portland cement mix was comparable to 90 1 -day compressive strength of calcium aluminate mortar. By adding the polymer to the mixtures, the compressive strength was reduced. It was also observed that by increasing the glass fiber content from 2% to 4%, compressive strength became lower. Upon increase in age, the compressive strength was enhanced due to the formation of polymer films in the porous structure of the mixtures and improvement of the cement hydration. In polymer modified specimens, the flexural strength was also increased due to the production of polymer films in the structure of mixes. Flexural strength was increased with the addition of glass fibers due to high aspect ratio of the glass fibers and well-formed Interfacial Transition Zone (ITZ). The addition of glass fiber from 2% to 4% influenced the bending strength of polymer specimens and had an enhancing effect on the tensile strength, flexural toughness, and impact resistance. However, in the durability test, fiber incorporated mixtures had higher chloride ion penetration. Adding fibers to the blends reduced the amount of shrinkage.

Key Words: Calcium aluminate cement, portland cement, glass fibers, polymer.

HETEROGENEITY AMONG INDIVIDUALS AND ALTERNATIVE IN DESTINATION CHOICE- CASE OF SHOPPING TRIPS IN QAZVIN

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Abstract

Modeling behavior of individuals in destination choice plays an important role in travel demand analysis and hence assessing transportation policies impact. Most researchers have used multinomial logit model, which does not allow for heterogeneity among individuals and alternatives. However, mixed logit models account for random distribution of coefficients in the utility function, hence heterogeneity of individuals. Heteroscedastic extreme value model, on the other hand, assumes an independent and non-uniform distribution of the error term, which leads to heterogeneity among alternatives. The purpose of this paper is to examine heterogeneity among individuals and alternatives in shopping trips destination choice in Qazvin. Multinomial logit (as the base model, not considering heterogeneity), mixed logit and heteroscedastic extreme value are calibrated and their results are compared. Unlike previous studies, individuals choose destination based on distance to their residence. Model results of 1570 shopping O-D trips based on various criteria (such as log likelihood and goodness of fit coefficients) indicate superiority of the mixed logit model. It was also observed that the individuals behave heterogeneously considering distance and departure time in choosing their shopping destinations. On the other hand, heteroscedastic extreme value model results were not much better than multinomial logit, thus relaxing the assumption of homoscedasticity if the error term in multinomial logit may not be necessary considering the small increase in model fit. This paper is an extension to conventional destination choice models by taking account of heterogeneity among individuals and alternatives enabling more realistic results helping decision makers in setting more effective policies.

Key Words: Destination choice, heterogeneity among individuals, heterogeneity among alternative, mixed logit, heteroscedastic extreme value.

EFFECT OF INITIAL PRINCIPAL STRESS ROTATION ON THE ANISOTROPIC BEHAVIOR OF SAND IN THE DRAINED CONDITION

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of pile groups increased upon an increase in the soil relative density, the group efficiency was reduced by 50%.

Key Words: Pile group, cross section shape, lateral resistance, sandy soil, pile arrangement.

FREE VIBRATION ANALYSIS OF SANDWICH PLATES WITH THE MAGNETIC VISCOELASTIC FLUID CORE USING SPLINE FINITE STRIP METHOD

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Abstract

Sandwich plates containing magnetic fluids in the core are considered nowadays as a smart structure. Due to the ability of rapid change in the viscosity of the fluid in the core, plate can be used to control the vibration of the structure and to deplete the energy. In the present study, free vibration behavior of a sandwich plate, which is made of composite glass-epoxy fiber face sheets and contains magnetic fluid in the core, is investigated. Based on the Hamilton's principle and considering independent bending degrees of freedom for upper and lower faces, free vibration governing equations of the plate are derived using the spline finite strip method. To validate the proposed method, the results are compared with those of other similar studies using different methods. Then, the effects of different parameters, e.g., diverse boundary conditions, which are rarely considered elsewhere, are evaluated based on the proposed formulation. Moreover, the frequency impacts as well as the modal loss factor, which are the two main parameters in the vibration analysis of these structures, are considered and the effect of different factors such as magnetic field intensity and fluid thickness in the core are investigated. The results indicate that the spline finite strip method has good accuracy in analyzing sandwich plates containing a flexible core. Besides, the results show that increasing the intensity of the magnetic field causes an increase in the frequency and loss factor corresponding to each mode. Moreover, increasing the thickness of the fluid leads to increase in the loss factor and decrease in the frequency. The results indicate that despite the change in the strain energy of the structure, due to changes in the fiber orientation of the composite layers, the frequency of each mode does not change significantly. It was also found that the clamped plate had the highest frequency and the simply supported boundary condition had the lowest frequency.

Key Words: Sandwich plate; magnetic viscoelastic fluid; composite; free vibration; spline finite strip method.

EFFECT OF COMBINED USE OF GLASS AND POLYMER FIBERS ON MECHANICAL PROPERTIES, SHRINKAGE, AND DURABILITY PROPERTIES OF CEMENT COMPOSITES

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Abstract

In this study, the mechanical properties and durability of composites containing fibers and polymers were investigated. For this purpose, calcium aluminate cement and Portland cement were used as binding agents. Glass fiber and polymer (Forton VF-774) were used to modify the mix. The specimens were prepared using 2% and 4% glass fiber (vol./vol) and 5% polymer by cement weight.

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Abstract

A wide variety of systems have been introduced so far for the construction of roofs, as one of the most essential structural components of buildings. A conventional roofing system is the solid slab that offers adequate rigidity to distribute gravitational and seismic loads, while it is also relatively resistant against fire. However, its main drawback is its overweight that increases the associated seismic loads. To resolve this problem, modifications were proposed that resulted in different types of biaxial voided slabs. In one such system, spherical and ellipsoidal plastic balls enclosed in steel cages were used to eliminate ineffective concrete. Due to the novelty of the system, however, little was known about the bending behavior of the roof thus constructed. Most of previous studies have been conducted on spherically-shaped voids ignoring ellipsoidal ones. This is while the effect of supporting cages on voids has not been investigated at all. The present study was, therefore, designed and implemented to study the behavior of biaxial voided slabs containing ellipsoidal plastic balls and the effect of supporting cages on bending behavior. To investigate these aspects of the system, two full-scale bending specimens were cast for investigating bending capacity, cracking distribution, and deflection in solid and biaxial voided slabs. Moreover, the effect of cage longitudinal rods was studied on the ultimate capacity of the bending specimens. Finally, the experimental results were then examined by ACI 318-14 recommendations to put forth suggestions for using the ACI 318-14 equations in designing biaxial voided slabs. It was found that while both solid and biaxial voided specimens exhibited almost similar bending behavior and the same failure mode. Also, the bending behavior of biaxial voided specimen was affected by the steel cages used. So, to use the ACI 318-14 equations, if this longitudinal cage bar is considered, the percentage difference between experimental and calculated results reached just one percent.

Key Words: Biaxial voided slab, flat slab, flexural behavior, ellipsoidal void, steel cage .

EFFECT OF CROSS-SECTION SHAPES OF PILES ON LATERAL RESISTANCE OF PILE GROUPS IN SANDY SOIL

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Abstract

Superstructures may be subject to lateral load like earthquake, wind, wave impact, and ship ducking. In these cases, engineers prefer to apply piles or pile groups. The exact predictions of the load-deflection response of pile groups under lateral loading have always been a big challenge for engineers due to the many parameters involved. These parameters include soil relative density, type of soil and its classification, water table elevation, length and diameter of pile, type of load, rigidity of pile and pile cap, etc. In this study, some experimental tests were performed to investigate the effect of cross-section shape of pile on lateral resistance of pile group. To consider the quantity of materials used to construct pile for optimum design, four different cross-section shapes of piles with the same surface area were used. The cross-section shapes of piles involved H pile, end closed pipe, square, and fin pile. Different conditions such as pile arrangement, pile spacing, and soil relative density for different cross-section shapes of piles were assessed. A poorly graded sandy soil was used. The lateral load was applied to pile groups using a 2.5 kN capacity jack and the deflection of pile cap was measured by a dial gage with accuracy of 0.01 mm. Results revealed that the ratios of lateral resistance of fin pile, square pile, and H pile groups to that of pipe pile group were 1.4, 1.19 and 0.85, respectively. By increasing the number of piles in group, the average lateral load per pile in the pile group was reduced for all pile shapes. Also, by increasing pile spacing from $3D_p$ to $6D_p$, the lateral resistance of each pile in group and also group efficiency of all pile shapes increased significantly. Although the lateral resistance

with the reduction of the distance between the stirrups, the bearing capacity of the column increased slightly. Moreover, with the increase of the eccentricity, the bearing capacity of the columns was significantly reduced and the slope of the descending branch of lateral load-displacement decreased gradually. Moreover, if the column was less slender, the axial load-displacement curve would have a greater initial slope and with increasing slenderness, the lateral load-displacement would have more nonlinear behavior due to increased second-order deformation. In addition, the axial load and stiffness of the composite column were significantly affected by the concrete compressive strength. The results also indicated that with increasing the eccentricity, the bearing capacity of the composite columns was reduced.

Key Words: Composite column, SRC, bearing capacity, eccentric loading.

EXPERIMENTAL INVESTIGATION OF COHESIVE SEDIMENTS EROSION IN THE PRESENCE BED COARSE-GRAIN SIZE SEDIMENTS

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Abstract

This paper studies the erosion of cohesive sediments in case of bed having coarse-grain size. Experiments were conducted in an annular flume with six different bed material grain sizes (D50=2.8 mm to D50=48 mm) at five different shear stresses and 24 hours of self-consolidated cohesive sediment placed on the bed material. The hydraulic parameters were measured using an Acoustic Doppler Velocimeter (ADV). The results showed that despite increase in flow shear stress in bed containing coarse grains, the amount of erosion of deposited cohesive sediments on the bed materials significantly decreased in comparison with the case of the smooth bed. Final concentrations of eroded cohesive sediment in the flow for smooth bed and coarse-grain size bed (D50 = 48.2 mm) were observed 47 and 1.9 g/l, respectively, showing that the coarse-grain size bed caused a reduction in the rate of cohesive sediment erosion up to 96% in comparison with the smooth bed, while the shear stress in case of the rough bed was 5.5 times more than that of smooth bed. The significant reduction in the erosion rate might be because of cohesive sediment trapping inside the void space of the bed materials so that the trapped fine sediment would not be re-suspended into the flow. In this work, the critical shear stress for erosion of deposited cohesive sediment was obtained as 0.12 N/m^2 for smooth bed and 0.16 and 0.92 N/m^2 for bed material with grain sizes of 2.8 and 48 mm, respectively.

Key Words: Entrapping, deposition, critical shear stress, consolidation, annular flume.

INVESTIGATION OF FLEXURAL BEHAVIORS OF BIAXIAL VOIDED SLABS WITH ELLIPSOIDAL BALLS AND STEEL CAGES

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PARAMETRIC STUDY OF FACTORS AFFECTING THE BEARING CAPACITY OF STEEL REINFORCED CONCRETE (SRC) UNDER ECCENTRIC LOADING

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Abstract

Due to the numerous advantages of Steel Reinforced Concrete (SRC) as a kind of composite columns over the reinforced concrete and steel columns, its use has been widespread in recent years, especially in high-rise buildings. In these columns, due to the presence of steel profiles in the reinforced concrete, the buckling of the steel components is delayed or does not occur, which would significantly increase the bearing capacity of the cross-section. In this research, a numerical study was carried out with the aid of ABAQUS software to investigate some of the factors affecting the load capacity of SRC columns under eccentric loading. A finite element model was validated based on experimental results. A total of 39 SRC columns were analyzed for parametric study. Geometric and material variables such as steel ratio, slenderness column ratio, eccentric loading ratio, compressive strength, and stirrup spacing were evaluated on the bearing capacity of the SRC columns. Also, based on the calculated values, the axial and lateral load-displacement as well as axial load-bending moment curves were plotted. The results showed that with increase in the steel ratio and the reduction of the distance between the stirrups, the ductility index increased, while