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Abstract

One of the most important effective parameters in earthquake, is behavior factor, which is depends on various factors such as structural geometric properties, structure ductility (performance level), fundamental period of the structure, damping, soil properties, earthquake characteristics (near- or far- field) and effect of higher modes. The most important feature of the behavior factor is that it allows the structural designer, to be able to evaluate the structural seismic demand, using an elastic analysis, based on force-based principles quickly. In seismic codes such as the Standard 2800, this coefficient is merely dependent on the type of lateral resistance system and is introduced with a fixed number. However, there is a relationship between the behavior factor, ductility (performance level), structural geometric properties, and type of earthquake (near fault and far fault). The purpose of this paper is to establish an accurate intelligent model related to the geometrical characteristics of the structure, performance level and the behavior factor in eccentrically steel frames, under earthquakes near-fault. For this purpose, genetic algorithm is used. Initially a wide database consisting of 12960 data with 3-, 6-, 9-, 12-, 15- and 20- stories, 3 column stiffness types, and 3 brace slenderness types were designed, and analyzed under 20 pulse-type near-fault earthquakes for 4 different performance levels. To generate the proposed model, 6769 training data were used in the form of adaptive-neural fuzzy inference system (ANFIS). Subtractive clustering and Fuzzy C-Mean clustering (FCM) methods have been used to generate the purposed model. The results showed that Fuzzy C-Mean clustering provides more accurate results than the other fuzzy inference system (FIS). To validate the proposed model, 2257 test data were used to calculate the mean squared error of the model. The results of correlation analysis of the proposed model show that the proposed intelligent model has high accuracy.

Key Words: Intelligent model, adaptive-neural fuzzy inference system, behavior factor, eccentric braced frame, pulse-type near-fault earthquake, performance level.

reinforced by geogrid, the highest value of the interaction coefficient was observed in the geofoam of 0.4% and then, in the geofoam of 0.2%.

Key Words: Firoozkooh sand(#.161), eps geofoam, geosynthetic reinforcement, direct shear test, coefficient of interaction.

A MULTI-OBJECTIVE OPTIMIZATION MODEL FOR SOLVING CONSTRUCTION SITE LAYOUT PLANNING PROBLEM CONSIDERING SAFETY AND RISK CRITERIA

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Abstract

This paper deals with construction site layout planning (CLSP) problem in the context of a multi-objective optimization model. According to the operational plans in Iran, in execution of the construction projects, special places are considered to accommodate the respective facilities in the jobsite. As an important part of project execution, the site layout planning has always been of concern for clients, contractors and consultants which is majorly intended to layout the facilities by properly arranging the them such as offices, warehouses, residences etc. such that materials, information and staff could be transferred optimally. Noteworthy, an appropriate layout improves level of safety and efficiency, reduces transport costs, prevents formation of bottlenecks and obstructions ahead of materials and equipment transfer particularly in mega projects. The site layout could be arranged with respect to the decision maker's opinions based on different criteria. The model's target functions include maximizing the safety level of construction facilities along with minimizing the corresponding costs and finally, minimizing the respective risks in potential areas. The constraints involve unique layout of each facility as well as the allowable distance between various facilities. Given the fact that the CSLP is classified as an NP-hard problem, it would be difficult to derive viable results using mathematical models whose solution process is time-taking as well. In this respect, to solve the numerical examples in a realistic representation scheme, NSGAII and MOGWO metaheuristic algorithms are applied. In order to compare efficiency of the proposed algorithms with the results derived from mathematical model solution, a number of standard measures have been used. The results indicate that the Pareto frontier produced by the proposed algorithms in numerical examples, is significantly in agreement with the optimal Pareto frontier in the case of small sizes approving great efficiency of the algorithms. Moreover, it was observed that in medium and large sizes, performance of the MOGWO surpasses that of NSGAII, making it appropriate for real-size cases. Lastly, results of this study could be considered as a management tool to make optimal strategic decisions aiming to develop the CSLP studies.

Key Words: Construction site layout planning (CSLP), safety maximization, multi-objective planning, NSGAII, MOGWO.

AN INTELLIGENT ADAPTIVE NEURO-FUZZY INFERENCE SYSTEM TO ESTIMATE THE BEHAVIOR FACTOR OF EBF STEEL FRAMES UNDER PULSE-TYPE NEAR-FAULT EARTHQUAKES

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Abstract

Enterprises and institutions need to evaluate their activity to determine the extent to which their goals have been achieved. One possible way to carry out this evaluation is to measure performance, for which organizations rely on metrics known as Key Performance Indicators (KPI). KPIs represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization and its ongoing projects. Thus, the right KPIs can be used to make improvements to construction organizations and projects. The main objective of identifying KPIs is to determine the main characteristics and definitions of them. Our research is intended to have a comprehensive study and review of available KPI definitions provided by previous related and valid works and also to identify the essential KPI characteristics. In order to identify the essential characteristics for a KPI to be efficient and effective and have a comprehensive review of KPI definitions, by searching the most related keywords to the topic, 133 articles were selected, 22 of which were related to KPI definition and 11 article papers were about the characteristics of right KPIs. After studying the selected articles completely, the same characteristics in different articles were combined together and recorded as a single characteristic with a specific number of repeats. By sorting the selected characteristics based on the number of repeats in other researches and in descending order, a complete list of essential characteristics for KPIs was provided. As a result of this research, based on a list of 51 characteristics of key performance indicators and by investigating all of the valid definitions of KPI methodology, a comprehensive definition was provided. At last, for each identified KPI, a complete definition with a practical example from organizations or projects in the context of construction industry was mentioned. The outcomes of this research could be a base for identifying the right KPIs in different industries, especially the construction industry.

Key Words: KPI, KPI characteristic, KPI definition, construction industry KPIs, performance measurement.

DETERMINATION OF THE INTERACTION PARAMETERS OF THE SOIL CONTAINING GEOFOAM BEAD-GEOSYNTHETIC REINFORCEMENTS

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Abstract

In the last few decades, due to the increasing use of geosynthetic reinforcements in reinforcing the soil, researchers have considered the significance of the behavior of the soil-geosynthetic interface. On the other hand, the use of geofoams in the form of block and/or bead due to a decrease in the weight of the soil mass behind the retaining structures has attracted the designers' attention. In this regard, the current research was carried out to determine the interaction parameters of soil containing geofoam beads and geosynthetic reinforcements. For this purpose, a large-scale direct shear apparatus with box dimensions of 304.8*304.8*152 mm was used. The used soil was a mixture of Firoozkooh sand (#.161) and geofoam beads with a diameter of 2 mm and the geofoam mix percentages were selected as 0.2, 0.4, and 0.6 percent by weight of the soil. Also, the reinforcements used in this research included geogrid, geotextile, and geocomposite; accordingly, further analysis and comparison of the obtained results could be possible. According to the results, in the sand-geofoam mixtures reinforced by geosynthetics, upon an increase in the mix percentage of geofoam, shear strength amounts decreased. Also, in these mixtures, the greatest increase in bearing capacity compared to the corresponding unreinforced mixtures was obtained for the samples reinforced with geogrid and also, for samples reinforced with geocomposite and geotextile, respectively. In general, based on the reinforcement type and geofoam mix percentage, an increase in the bearing capacity of the reinforced mixtures with respect to unreinforced mixtures was about 12% to 135%. By increasing the mix percentage of geofoam from 0.2 to 0.6, the amount of this increase was reduced. In the sand-geofoam mixtures reinforced by geosynthetics, the highest value of the interaction coefficient was obtained in the samples reinforced by geogrid, geocomposite, and geotextile, respectively. In the sand-geofoam mixtures

are considered: fixed tolls for all days within the analysis period, and variable tolls in response to the network conditions in each day. Also, depended on providing information, the drivers can be either aware or unaware of accident occurrence. The problem is solved for combinations of different states of pricing schemes (fixed or responsive) and information provision (no or full) for the network of Sioux-Falls. Numerical results show that providing information to drivers becomes more important than congestion pricing as the level of uncertainty increases, and especially when severe accidents occur. Besides, applying fixed tolls is no longer beneficial when drivers are equipped with ATIS. Applying responsive pricing and ATIS can reduce the total travel time of the network by 11.8 percent. Moreover, some results from a sensitivity analysis on accident severity and accident probability are reported, showing that as accident severity increases, fixed tolls become more useful for congestion reduction.

Key Words: Transportation networks, dynamic congestion pricing, traffic accidents, ATIS.

OPTIMAL CONTROL OF JACKET PLATFORM UNDER WAVE VIBRATION WITH ACTIVE TUNED MASS DAMPER

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Abstract

In recent decades, different control strategies (i.e., passive, active, semi-active, or hybrid) have been extensively employed to suppress the response of offshore structures subjected to dynamic lateral loads. Jacket platforms are vital structures for oil-rich countries that are frequently subjected to dynamic harsh sea waves. Therefore, the vibration control of these structures is substantial to increase productivity, safety, and serviceability and prevent premature possible fatigue failure. In this study, the behavior of the Ressalat platform located in the Persian Gulf is evaluated under wave loads with two different return periods of 50 and 100 years. A simplified equivalent seven-degree-of-freedom lumped mass linear model is adopted for the Ressalat platform. In the Persian Gulf, wave loads are the dominant load in the designing procedure. Due to the stochastic nature of wave loads, random wave and constrained new-wave theories are utilized in the generation of the wave records. Then, Passive Tuned Mass Damper (PTMD) and Active Tuned Mass Damper (ATMD) are employed to suppress the platform vibration and subsequently, their control performances are compared. Various calculated normalized performance criteria (responses of controlled to uncontrolled structures) for passive and active controlled platforms including normalized maximum and Root Mean Square (RMS) of displacement, velocity, and acceleration of the deck level are calculated and compared. The uncontrolled and controlled platforms are modeled and analyzed using MATLAB and SIMULINK software. Moreover, the fuzzy intelligent algorithm with a triangular membership function is implemented to calculate the control force and the Harmony Search Algorithm (HAS) is examined to optimize the actuator power. Also, the Fluid-Structure Interaction (FSI), the effect of added mass due to the accelerated motion of the body in the fluid, and the saturation of the actuator are considered. The results show the effectiveness of the proposed control system by reducing 20% and 50% of the maximum and RMS of the platform deck acceleration, respectively, over time.

Key Words: Jacket platform, active tuned mass damper, harmony search algorithm, fluid-structure interaction.

A COMPREHENSIVE STUDY OF CHARACTERISTICS OF CONSTRUCTION ORGANIZATIONS AND PROJECTS KPIS

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PROCESS WITH IRON AND ALUMINUM MODIFIED BY ZINC OXIDE NANOPARTICLES BY CYCLIC VOLTAMMETRY IN REMOVAL OF REACTIVE BLUE 19 DYE

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Abstract

In recent years, the processes used in wastewater treatment have received significant advances in various fields, including the electrochemical coagulation process as a significant innovation in the water and wastewater industry. The application of electrochemical technologies in the water and wastewater industry is very diverse. This technique has been applied in various situations and industries to remove a wide range of pollutants. Reactive dyes are a group of dyes widely used for dyeing cellulose fibers, especially linen fabrics used. The anthracavon dyes after the azo dyes are the second group of textile dyes. Reactive blue 19 is the anthraquinone dye in terms of color factor. Various methods have been used to treat this type of wastewater, including various physical and chemical treatment methods (such as filtration, settling, ozonation), each with its own disadvantages such as: low efficiency, high cost, high time and cause secondary pollution. Accordingly, electrochemical coagulation treatment to remove contamination from dye wastewater due to its high efficiency is studied. The purpose of this study was to evaluate the electrochemical removal of reactive blue 19 dye using iron and aluminum electrodes. The dye concentration was also considered at 200 mg/L for all stages and all experiments were performed at ambient temperature. Main parameters such as electrode spacing, type of electrode arrangement, anode electrode (iron and aluminum), coating of aluminum electrode with ZnO nanoparticles by physical evaporation layer-addressing method and evaluation of coating performance by scanning speed cyclic voltammetry system and different voltage ranges were used. In the optimum condition in the removal of synthetic contaminants including electrode distance of 3 cm, parallel monopolar electrode arrangement, use of iron anode electrode pair and aluminum cathode with ZnO nanoparticle coating, retention time equals to 32.66 minutes, current density 14.34 mA/cm^2 and initial pH of 4, the percentage of dye wastwater was 93.8 percent. The use of zinc oxide nanoparticles coated by the physical evaporation layering method also improved the 173.12% electrical current.

Key Words: Electrochemical coagulation, reactive blue 19, physical vapor deposition, cyclic voltammetry, nanoparticles Zinc Oxide.

DYNAMIC CONGESTION PRICING CONSIDERING CAPACITY VARIATIONS AND ADVANCED TRAVEL INFORMATION SYSTEMS IN URBAN NETWORKS

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Abstract

Traffic accidents reduce the capacity of transportation networks and increase the travel delays. Advanced traveler information systems (ATIS) provide the drivers with information about these accidents, so that the uncertainty about the route capacities decreases and drivers can choose better routes to their destinations. Congestion pricing is among the traffic management policies, whose performance is directly affected by the availability of information to drivers. In this paper, an analytical dynamic traffic assignment model is proposed which can take account of tolls charged to drivers. An iterative algorithm is also proposed to solve the model for large-scale networks. Moreover, the assignment model is used as the sub-model within an optimization model proposed for dynamic cordon pricing problem. To solve the pricing model, a solution algorithm is developed which works based on a grid search method. Two pricing strategies

number of loading combinations including gravitational and lateral wind loadings. As the structural behavior depends on the distribution of section profiles among its members, sizing optimization is employed for screening the diagrid designs. Optimization is performed by a meta-heuristic algorithm inspired by hunting behavior of Falcons that samples the design space without need to any gradient calculation. The algorithm is recently developed in 2019 and applied for heat exchanger design. It simulates the hunting flight in: 1) logarithmic spiral flight in which the Falcon keeps its head straight looking sideways at the prey with maximum visual acuity, and 2) diving toward the prey by binocular vision. The first stage provides exploration while the second models search intensification in such a meta heuristic algorithm. In addition, the phenomena of klepto-parasitism between falcons is modeled to enhance the search. In order to apply both axial and flexural section properties in such a discrete problem, profile indices are taken as design variables. They are to be selected from the practical list of profiles during optimization. Member grouping is also employed to deserve symmetry and other practical considerations in the models. Consequently, diagrid design is fixed by minimizing the structural weight under code-based stress and deformation constraints. The designs are distinctly obtained for two cases of rigid and flexible soil-structure connections. By an external penalty approach, constraints are checked under simultaneous gravitational and wind loadings to be satisfied in the final optimal designs. Applying pushover analyses, various measures are studied and compared showing importance of soil-flexibility not only in the optimal costs but also in non-linear structural responses.

Key Words: Diagrid, meta-heuristic algorithm, sizing optimization, soil-structure interaction, wind loading.

STUDY ON THE PARAMETERS AFFECTING RECTIFYING ASYMMETRIC SETTLEMENT OF CONCRETE BUILDING FOUNDATIONS BY JACKING METHOD

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Abstract

Tabriz, one of the metropolises of Iran, has a particular geotechnical condition. Recently, it has been reported that some of the new structures are tilted in Freshteh town located in the northwest of Tabriz. Different thicknesses of the first subsurface layer, the high level of ground water, and the presence of sand layers between the clay layers are the main reasons for uneven consolidation settlement of buildings in the mentioned area. Residents usually do not feel safe to live in these tilted buildings. However, demolishing and reconstructing tilted structures is a waste of money, unless there is no other solution. Moreover, the demolishing of valuable historical buildings is out of choice. Thus, restoration processes for tilted structures should be considered and developed. Various methods are used to rectify the tilted structures including compaction grouting, underpinning of the foundation, chemical grouting, jacking, soil extraction technique, etc. Among different methods for rectifying uneven settlement of structures, in this study, because of some advantages, the jacking technique has been chosen to rectify the Tilted Reinforced Concrete (RC) buildings. This method can be used in dense urban areas and the residents can stay in their apartment or office in much of the rectifying process. Geotechnical finite element software of Midas GTS NX was used for numerical modeling and analysis of this direct soil-structure interaction rectifying project. The results were verified based on the data reported by Ma et al. (2008). The force applied by the jacks to rectify the uneven settlement should continue until the two sides of the foundation would reach the equal value of vertical displacement, or the uneven settlement of the foundation is reduced to the minimum possible amount. Also, the structural elements of the building should be able to withstand the force applied by the jack and do not crack or collapse during the rectification stages.

Key Words: RC building, differential settlement, soil-structure interaction, jacking rectification technique, numerical study.

APPLICATION OF ELECTRO-CHEMICAL COAGULATION

of the pile. By increasing the amount of properties such as soil thermal conductivity, pipe diameter, pipe length, the flow rate of fluid in the pipe, length of the pile, the efficiency of the system will be improved. However, increasing the wall thickness of the pipe reduces the amount of extracted energy.

Key Words: Renewable energy, geothermal energy, energy piles, thermal output power, heat transfer in soil.

DESIGN AND DEVELOPMENT OF THE EXPERIMENTAL APPARATUS FOR STUDY OF SOIL INTERNAL EROSION IN 2D SEEPAGE

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Abstract

Internal erosion refers to the seepage-induced movement of a fraction of soil particles in such a way that the initial state of the soil structure changes. Accordingly, severity and mechanism of the particle movement depend upon the geometric, mechanical, and hydraulic conditions, which is of a higher probability in the case of concave upward and gap-graded soils. Internal erosion is one of the long-lasting challenges in the design of earth dams and engineering fills to which considerable attention has been given. To date, extensive studies have been conducted on the four regular types of internal erosion such as concentrated leak erosion, contact erosion, backward erosion, and suffusion; subsequently, various techniques and criteria have been proposed for identification and assessment of this phenomenon. Hence, the previous studies are mainly focused on the geometric parameters (e.g., gradation, void ratio, etc.), whereas the mechanical and hydraulic factors have gained less attention. However, most of the studies and experimental apparatuses for evaluating the occurrence of these phenomena in susceptible soils have been in terms of one-dimensional (upward or downward) flow applied perpendicular to the soil layers. There is also no mention of the effect of flow direction and direction of the layers in the existing criteria for evaluating internal stability, whereas natural deposits and even engineering fills are not necessarily perpendicular to the direction of the layers. Also, flow direction towards gravity is not necessarily zero or 180 degrees and may be present in any case Therefore, in this study, a special physical model was designed and developed to study samples of gravel size and different directions of layers and inflow. The results of experiments carried out on gap-graded soils show that the critical gradients are more in soils with perpendicular layers than those with parallel layers. Also, as the angle of flow relative to the direction of gravity increases, the critical gradients generally increase; in addition, the direction of the layers relative to the inlet flow to the soil specimen completely affects the shape of eroded pipes in the soil.

Key Words: Internal erosion, testing apparatus, flow direction, layers inclination, critical gradients.

SOIL FLEXIBILITY EFFECT ON OPTIMAL DIAGRID SIZING BY A FALCON OPTIMIZATION ALGORITHM

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Abstract

Diagrids have received much attention in recent years as lateral-load resistant systems. Most of previous research works have modeled the structure on rigid foundations. It is while the present work takes into account the static soil-structure interaction in a planar 20-story example with a constant diagrid angle. A finite element program is provided for analyzing diagrid systems under a

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Abstract

Performance of fiber reinforced Engineered Cementitious Composites (ECC) strengthened by non-ductile Reinforced Concrete (RC) frames with hollow clay brick masonry infill subjected to quasi-static in-plane loading was experimentally assessed herein. The suggested strengthening technique was used for increasing the lateral strength of infilled RC frames and retaining the integrity of the masonry infill wall during earthquake loading. Initially, the mechanical properties of ECC and masonry elements were tested. The ECC was made of water, cement, silica fume (5% of cement weight), Zeolit (5% of cement weight), silica sand, fly ash, superplasticizer, and Poly-Vinil-Alkaol fibers (1.5% of the whole volume of the concrete). Cylinder and Dog-bone specimens were cast and tested to evaluate the compressive and tensile stress-strain behavior of ECC concrete. Afterward, three RC specimens with one-third scale and one bay-single story. Of these specimens, one frame was tested as built without infill (BF) and another frame as built with infill (IF-E0), and the rest of the frames were retrofitted using ECC as an overlay on the masonry wall (IF-DF-E20-1). The infilled frame strengthening using ECC (IF-DF-E20-1) provided lateral strength, stiffness, and energy dissipation capacity of 2.31, 1.11, 1.37 times those of the hollow clay brick masonry infilled frame (IF-E0), respectively. Furthermore, the obtained backbone curves are idealized using a two-line model. The relative displacement of each floor is an important issue in the structural and non-structural seismic designs; thus, the initial cracks (flexural in columns, diagonal in beam-column joint, flexural in beams, cracking in the interface of the frame and infilled bricks, crushing of bricks, shear crack in column, sudden crushing of infill, and concrete crushing of column) at the respected displacement was analyzed here. According to the results, the proposed strengthening technique not only increased the lateral strength and energy absorption capacity of the infilled frame but also provided a reasonable system overstrength and prevented brittle failure modes in the infill wall.

Key Words: Engineered cementitious composites (ECC), seismic strengthening, masonry infill wall, non-ductile RC frame, quasi-static loading.

NUMERICAL INVESTIGATION OF THE FACTORS AFFECTING THE OUTPUT POWER FROM HEAT EXCHANGER PILES

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Abstract

At present, global warming is one of the crucial problems for the world. One of the most important reasons for this problem is fossil fuels. Fossil fuels are the main cause of global warming and pollution. One of the best ways to solve this problem is to use renewable and clean energy resources. So today, the use of renewable and clean energy gains more popularity. One Type of these resources is geothermal; that has many resources and availability. This energy is used for heating and cooling of buildings, tunnels, avoid freezing roads and bridge and so on and by means of Energy Piles this energy is extracted.

This scope of knowledge can be studied by two different views; the thermomechanical behavior and amount of extracted energy from Energy Piles. In this paper, the latter case is studied numerically to evaluate effective parameters on its energy efficiency. Because this system consists of three main elements, which are pipe, concrete, and soil, the thermal properties of each element is studied separately. In soil adjacent to the pile, some parameters like groundwater flow and the environmental conditions can influence the efficiency of the system. The geometrical properties of pipes, like installation shape, wall thickness, and diameter, are based on industrial standards. The geometrical properties of all elements can influence the efficiency of the system. Some conditions in pipes, which are imposed from the ground heat source pump (GHSP): like the flow rate in pipe and flow conditions, are also effective on the amount of extracted energy.

In this paper, the amount of output energy was reported which is normalized with respect to time and the length

the tip of the beam. Loading continued until the load dropped to more than 30-40% of the maximum load. Also, to simulate the actual sample, the compressive load of fifteen tons continuously entered the column. The mixing technique for producing highly dispersed nanomaterial in cement mortar is crucial as it directly affects the mechanical properties of the cementitious composite. In this study, a surfactant (plasticizer) and Arabic Gum were used in order to get a homogenous dispersion of CNT in water. According to the results in the sample containing CNT in the plastic joint, it absorbs the highest amount of energy at the end of loading, which was 28% and 55% higher than ECC and NC, respectively. In addition, results indicated that the use of ECC-CNT in the plastic bonding zone had a significant effect on the energy absorption and relative deformation of the joints.

Key Words: Experimental investigation, reinforcement concrete, joints, carbon nanotubes (CNT), engineering cementitious composite (ECC).

NUMERICAL AND PARAMETRICAL INVESTIGATIONS OF THE BEHAVIOR OF COMPOSITE STEEL PLATE SHEAR WALLS WITH OPENING

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Abstract

The use of steel shear walls has been considered as a lateral load-bearing system in tall buildings. The significant advantage of Composite Steel Plate Shear Wall (CSPSW) is that the buckling of the infill steel plate, which is a serious disadvantage of Steel Plate Shear Wall (SPSW), is prevented. In order to enhance the seismic behavior of the system, the analytical study of CSPSW with a reinforced concrete panel with a gap between the concrete panel and steel frame was conducted. Hence, CSPSWs could be considered as an alternative lateral resistance system in steel structures, which is typically utilized as an effective lateral load-resisting system in high-rise buildings, where the story shear loads were markedly large. In this study, several parameters such as opening shape, opening location, and opening area in composite steel plate shear wall were considered in nonlinear static analysis using ABAQUS software. The numerical model was validated using an experimental model that had differences of 2.3% and 2.9% in elastic stiffness and load-bearing capacity, respectively. After ensuring proper performance and accuracy in predicting the behavior of the system, 16 numerical finite element models were simulated. The analysis results showed that using the concrete panel caused by transferring the failure mode from steel plate failure and buckling of plate to cracking and crushing the concrete led to a 13% increase in the load-bearing capacity. The most suitable type of opening shape is circular in shape with a load-bearing capacity of 5% more than the rectangular shape. Also, using a square opening can create the highest ratio of opening without geometric interference with other members in the shear wall. The behavior of CSPSWs and corresponding SPSWs is utterly disparate. The infill steel plate of SPSW resists lateral load by the development of tension fields as the infill steel plate initiates elastic buckling. However, in CSPSW, the elastic buckling of the infill steel plate is prevented by introducing a reinforced concrete panel; hence, the infill steel plate carries out lateral load by pure shear yield. Moreover, during the lateral load, CSPSW undergoes four stages: initial elastic stiffness, shear yield stiffness, post-shear yielding stiffness, and pre-failure stiffness.

Key Words: Composite steel plate shear wall, nonlinear static analysis, finite element method, opening.

ENGINEERED CEMENTITIOUS COMPOSITES EFFECTS ON SEISMIC STRENGTHENING OF NON-DUCTILE RC FRAMES WITH MASONRY INFILLS

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Abstracts of Papers in English

EXPERIMENTAL INVESTIGATION OF THE CONCRETE BEAM-COLUMN JOINTS BEHAVIOR WITH CNTs MODIFIED ENGINEERING CEMENTITIOUS COMPOSITE

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Abstract

Carbon nano-materials, especially Carbon nanotubes (CNTs), are the most prospective advanced materials for application in cement-based products for the construction industry due to their excellent material properties. An appropriate design for beam-column joint structures is required to meet the requirements of strength and ductility to prevent any sudden failure. Under seismic action, this beam-column joint zone is considered the most sensitive zone that undergoes different shear stresses in different deflections. The seismic performance of beam-column connections and joints can be enhanced by using improved details in the joints, ensuring a strong connection behavior. However, the use of dense reinforcements brings about executive problems such as lack of concrete condensation. This paper investigates the effect of Engineering Cementitious Composites containing Carbon Nanotubes (ECC-CNT) on the behavior of RC exterior beam-column joints under reversed cyclic loading. In this study, three beam-column concrete joints were tested, one of which was the reference specimen. The two other joints of the critical area of beam-column connection were replaced with Engineering Cementitious Composite (ECC) and ECC-CNT. The main parameters considered include the moment-deflection relationship, the energy absorption capacity, hysteresis curve, and crack propagation. The specimen was subjected to a reversed cyclic loading under control deformation at