Relationships between the Rheological Properties of Fresh Concrete Containing Admixtures and Some Test Results on Fresh Concrete†

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ABSTRACT

Properties of fresh concrete are determined by using coaxial viscometers. However, these devices are not widely used since they are very expensive therefore can only be used in laboratories. In this study, properties of fresh concrete were determined using Slump, J Ring, K Slump and Two Point Workability tests (CTPT), on concrete mixes having different composition characteristics (types of aggregate, minerals, chemical and fiber admixtures) for three different cement dosages. The results obtained from each test are correlated with each other. In addition, the results obtained from Slump, J Ring, and K Slump tests are also correlated with CTPT test results. According to the obtained results, rheological parameters differ due to cement dosage and type of plasticizer admixture. The highest determination ratios are obtained for J ring tests when used with slump cone.

Keywords: *Tests of fresh concrete, workability, rheological parameters, concretes containing admixture*

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Investigation of some Quality Parameters of Underground Water in the Göksu Plain with Probabilistic and Geostatistical Techniques†

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ABSTRACT

Exploitation of excessive water may cause saltwater intrusion in coastal aquifers. In order to determine and prevent saltwater intrusion, the results of level and quality measurements together with the variations in underground waters at wells are evaluated and necessary measures are taken. The aim of this study is to evaluate the changes of electric conductivity (EC, dS/cm), total dissolved solids (TDS, mg/l) and chloride (Cl, mg/l) values observed in 23 underground water (UGW) wells located in the Göksu plain, in July, 2002 by applying probabilistic and geostatistical methods. Kriging estimated maps are drawn and two dimensional variations of the parameters are investigated. It is concluded that the use of UGW wells at 40% of the studied area is inconvenient. As the seashore is approached, the levels of EC, TDS and Cl parameters are at threatening levels in view of sustainability of agricultural production.

Keywords: *Groundwater quality, saltwater intrusion, geostatistics, kriging, frequency analysis.*

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Investigation of Geogrid Performance on Highway Subbase By Using The Pullout Test Device†

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ABSTRACT

In this study, the shear strength performance of geogrids that are used as reinforcement on highway subbase are examined. For this purpose, a specially designed pullout test device is developed and used. The test device is first that is used in Turkey which has dimensions of 1 m length,1 m width and 0.80 m height. Three different sizes of geogrid dimensions are used in the tests with apertures 3 cm x 3 cm, 4 cm x 4 cm, 5 cm x 5 cm, respectively. Variations of shear strengths of geogrids due to time are investigated. The horizontal displacements of geogrid samples are determined both by image technique and diplacement sensors. It has been observed in tests for all the geogrid types that while soil parameters, vertical pressure loads and pullout speed are maintained constant and the tensile force is applied to geogrids, pullout force increases to a certain peak, where it starts to decline. It is concluded that geogrid aperture size has a considerable effect on highway subbase shear strength and displacements while the effect on the pullout force is negligibly small.

Key words: *Geogrid, the pullout test device, tensile strength.*

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Interval Finite Element Analysis of Truss Systems†

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ABSTRACT

In this work, geometric uncertainties due to fabrication errors and/or thermal changes in truss structures are investigated. The system components' deviations from the nominal dimensions (misfitting) are defined as intervals. Such geometric uncertainties are converted into equivalent nodal loads. In the case of truss systems the Interval Finite Element formulation leads to a linear interval system of equations. The results are illustrated in the problems solved as examples.

Keywords: *Geometric uncertainty, interval analysis, interval finite elements, fabrication errors.*

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Strengthening of Reinforced Concrete T-Beams with Steel Plates†

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ABSTRACT

Bonding of steel plates to the bottom surface of reinforced concrete beams is a common technique of strengthening against bending. However, in the studies carried out up to date, significant ductility related problems have been observed. In this study, a simple and practical end connection has been developed that enables the beams strengthened by this approach to reach adequate ductility capacity in addition to the strength. In this experimental study, a total of eight beams scaled 1/1, have been prepared and tested two of which were used as reference beams. Of the remaining six specimens, three beams were strengthened solely against bending while the final three were strengthened against both shear and bending. Despite an approximate increase of two and half times in strength, the beams were observed to behave in a quite ductile manner.

Keywords: *Reinforced beam, repair, strengthening, steel plate*

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Utilization of Pumice and Zeolite in High Strength Concrete†

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ABSTRACT

In this research, the use of pumice (P) and zeolite (Z) natural pozzolans as mineral admixtures for high strength concretes has been investigated. For this purpose, four different types of high strength concrete are designed, by adding pumice and zeolite with proportions of 0%P-15%Z, 5%P-10%Z, 10%P-5%Z 15%P-0%Z, respectively. Produced concrete specimens are subjected to several physical and mechanical tests. The test results are evaluated using statistical methods. In conclusion, it is determined that concrete mixtures with 0% Pumice - 15%Zeolite (0P15Z) and 5% Pumice-10% Zeolite (5P10Z) can be used in high strength concrete production.

Keywords: *High strength concrete, pumice, zeolite*

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Shear Locking Free Finite Elements for Thick Plates on Elastic Foundations[†]

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ABSTRACT

In this study, the analysis of thick plates resting on an elastic foundation is investigated by using four-noded (PBQ4) and eight-noded (PBQ8) quadrilateral finite elements based on Mindlin plate theory and by taking into account transverse shear deformations. In order to avoid the shear locking problem in case of small thicknesses, selective reduced integration technique is used in addition to full integration technique for the evaluation of the stiffness matrices of both elements. Various loading and boundary conditions are considered and a reference example is solved for comparison. It is concluded that the results obtained by using PBQ4 and PBQ8 elements are both satisfactory for thicker plates. However the selective reduced integration technique is more reliable for thinner plates.

Keywords: *Finite element, thick plate, elastic foundation, shear locking problem.*

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Real-Time Optimal Operation of Multiple Reservoirs System†

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ABSTRACT

In this study, a water resources system with multiple objectives and multiple reservoirs is described. Optimal operation models of long term with energy production objective, short term with flood control objective and real-time with both flood control and energy production objectives are developed for the system. In the developed models, optimization technique of the dynamic programming with successive approximations (DPSA) is used. Optimal operation models obtained from long and short terms are used as guide levels in real-time optimal operation model. The objective function in the real-time optimization in probable flood cases, is about both minimization of flood damage and providing optimal energy production. In real-time and short term optimal operations, kinematic wave approach is used for carrying the inflows released from one reservoir to the other reservoir. The models are applied to a water resource system with multi-reservoirs existing in the Ceyhan Basin. The results obtained are evaluated in terms of flood control and energy production.

Keywords: *Real-time optimal operation, long and short term optimal operation, flood control, energy production, dynamic programming with successive approximations.*

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Empirical Methods for Predicting Suspended Sediment Load in Gediz River†

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ABSTRACT

It is essential to predict suspended sediment load for understanding river morphology, design of dams, water supply problems, management of reservoirs and determination of pollution levels in rivers. The suspended sediment load can be determined by means of several methods such as direct measurements at the sediment gauging stations, sediment rating curve, soft modeling methods, and empirical methods which are based on experimental works. The objective of this study is first to determine the best empirical method for Gediz river and then to improve the determined method by genetic algorithm (GA). It is seen that the GA improved Brooks method can be used for Gediz River Basin. In addition, this method was compared with other soft computing (ANN, ANFIS) methods and its performance is found to be as good as those.

Keywords: *Suspended sediment, empirical methods, Gediz basin, brooks method, genetic algorithm, soft computing methods.*

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Three-Dimensional Spiral Staircases with Two Helical Portions and a Circular Landing†

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ABSTRACT

In this study, the statical analysis of three-dimensional spiral staircases modeled as space bar structures has been investigated by three different analytical methods. The first approach uses the force method and an attempt is made to obtain a closed solution for the statically indeterminate spatial system. In the second method, a finite element analysis is conducted by means of the program SAP2000 resulting in a discrete solution. The third approach models the structure as an equivalent spiral staircase of the same height and helical angle without a landing and an approximate solution is obtained by means of the force method.

The internal loads obtained by each of these methods are compared through a numerical example and the reasons for the differences in internal forces with respect to the exact solution are investigated.

Keywords: *Helical staircase, force method, discrete solution*

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Additional Loads Transferred to Cantilever Beams of RC-Buildings†

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ABSTRACT

It is a very common application, especially in Turkey, to support parts of a RC building by cantilever beams in order to increase the storey areas above the entrance level. In many of these buildings, cracks of various sizes within the infill walls above the lowest level cantilever beams may develop in time. In this study, the reasons for the development of these cracks are investigated. It is experimentally found out that, one of the reasons for these cracks are the additional loads that are transferred from the upper level cantilever beams to those at the lower levels through the infill walls. The results of the study suggest that about 25% of the upper cantilever beam loads are transferred to the cantilever beam below. Useful recommendations for practice are presented.

Keywords: *Cantilever beam, infill wall, crack, load transfer.*

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Pseudo Dynamic Testing Methodology and an Application†

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ABSTRACT

Pseudo dynamic testing methodology which aims to simulate the earthquake behavior of specimens consists of both numerical and experimental analyses in an interactive manner. The dynamic equilibrium equation is generated with the restoring forces measured from the specimen and the predefined mass and viscous damping properties. The displacement vector to be applied to the specimen in the next step is calculated by a proper numerical integration technique. Due to application of the loading function in a quasi-static manner, local behavior and damage propagation of the test structure could be traced. The pseudo-dynamic testing algorithm developed for single-degree-of-freedom systems was used in the tests of reinforced concrete frames.

Keywords: *Pseudo dynamic test, simulated dynamic loading, hybrid test.*

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Investigation of the Volatility in Stream Flow Time Series with Nonlinear Variance Models: Case Study of Köprüçay River†

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ABSTRACT

In stream flow series modeling by the conventional time series models (AutoRegressive Moving Average - ARMA) under the assumption of constant variance, the mean behavior of the process is focused on and the non-linear effects based on variance behavior are neglected. Modeling of this nonlinear phenomenon with variance behavior and water resource management of hydrological processes which involve risk and uncertainty gains importance. This is true for modeling with AutoRegressive Conditional Heteroskedasticity (ARCH) or with its general form, Generalized AutoRegressive Conditional Heteroskedasticity (GARCH). In this study, the mean behavior of the daily and yearly stream flow series of the Köprüçay River is modeled with the linear time series models (AR, MA, ARMA) and the best fit models are selected. The volatility presence is searched by using the Engle's Lagrange Multiplier (LM) Test on the residuals from the linear models, and the conditional heteroskedastic variance models (ARCH-GARCH) are developed. It is shown that the ARCH effect in the daily stream flow series can best be modeled with ARMA(1,1)-GARCH(2,3) and the volatility does not exist in the yearly stream flow series. The volatility clustering in daily stream flow series is shown with the conditional standard deviation and variance graphs. It is expected that, this study can be a useful contribution to the statistical modeling of stream flow processes.

Keywords: *Volatility, autoregressive conditional heteroskedasticity (ARCH), generalized autoregressive conditional heteroskedasticity (GARCH), lagrange multiplier test, Köprüçay River.*

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A Regional-Scale Transient Groundwater Flow Model for Torbali, Turkey†

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ABSTRACT

Torbali is one of the suburbs of İzmir which is the third biggest city of Turkey. Excessive withdrawal of groundwater for drinking, agricultural and industrial activities causes a significant decline of groundwater level. The aim of this study is to develop a three-dimensional transient groundwater flow model in order to predict groundwater levels for forthcoming years, in the light of available data concerning inflows and outflows. After the calibration of the model by using data corresponding to the period 1996 - 2004, the groundwater level variations until the year 2020 are predicted. According to the model results, it is revealed that groundwater level will decrease approximately 8 meters between the years 2000 and 2020.

Keywords: *Groundwater flow, numerical modeling, Torbali, Turkey*

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Evaluation of the Performance Limit States of Reinforced Concrete Columns in View of Experimental Observations†

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ABSTRACT

In this study, twelve full-scale column specimens designed for pure flexure were tested under repetitive displacement cycles with high amplitude. Two typical column designs were employed in the production of samples representing sub-standard and code-conforming columns, respectively. The main variable in the experiments was the histories of the imposed displacement amplitudes. The deformation-based performance limits proposed by Eurocode 8, ASCE/SEI 41 and Turkish Seismic Code (TDY-2007) for sub-standard columns were found conservative in view of the test results, which may lead to misleading results in seismic risk assessment of existing concrete structures. On the other hand, according to the test results of code-conforming columns, the performance limits predicted by Eurocode and TDY 2007 are found to be reasonable. However, ASCE/SEI 41 performance limits appear to be somewhat conservative especially in predicting the experimental performance of column plastic hinges under moderate axial load levels.

Keywords: *Concrete columns, flexure, plastic hinges, performance limits, seismic codes*

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Effects of Soil Group on the Cost of Industrial Structures†

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ABSTRACT

Recent occurrences of major earthquakes have necessitated the introduction of new rules and restrictions in the technical specifications in the whole world as well as in Turkey. In this context, in Turkey the current earthquake specification has been revised and the Turkish Earthquake Code-2007 is published in 2007. In Turkey, in the construction of industrial structures, structural steel, reinforced concrete and prefabricated reinforced concrete systems or a combination of these systems are used as the structural system. In this study, a group of single-story industrial structures having different column spans were selected and individually designed for structural steel, cast in-situ reinforced concrete and prefabricated reinforced concrete materials. In designing each sample structure, the soil groups given in the specification TEC-2007 were taken into consideration and the corresponding costs were calculated. The results obtained were evaluated to compare the costs of different structures.

***Keywords**: Structural cost, earthquake, industrial structures, soil group.*

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Effect of Homogeneity on Flood Estimation at the West Mediterranean Region†

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ABSTRACT

In regional flood frequency analysis, identification of homogeneous sub-regions is a fundamental factor for reliable flood quantile estimation in hydrologic modeling, engineering practice for water structures design and management. In this study, regional flood frequency analysis is carried out for annual maximum flood series of stream gauging stations with Dalrymple and L-moments homogeneity approaches for the West Mediterranean River basins in Turkey. The studied region is divided into three homogeneous sub-regions namely Antalya, Lower West Mediterranean and Upper West Mediterranean based on Dalrymple and L-moment homogeneity tests. Design floods with various recurrence intervals are calculated for stream gauging stations in each homogeneous sub-region. The results showed that the difference between design floods with various recurrence intervals according to the homogeneity tests is not significant at small recurrence intervals but this difference increases at large recurrence periods especially for stations that have high coefficient of variation and skewness.

Keywords: *Homogeneity, regional analysis, flood, design flood estimations.*

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Determination of the Flexural Damage Curvature Capacity of R/C Columns†

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ABSTRACT

Instead of force based design methods, performance based design methods have been widely used especially for resistance assessment of existing buildings. Performance based design methods produce more realistic results compared to force based design methods for predicting probable structural damage level for a given earthquake considering inelastic properties of materials. To implement performance-based earthquake engineering, it is necessary to relate deformation demands placed on structural components to specific levels of damage. Turkish Seismic Design Code defines three different damage limit states and corresponding concrete and reinforcement steel strain limits representing probable damage occuring at critical sections of R/C structural members. These limits are Minimum Damage Limit; Safety Limit and Collapse Limit state.

In this study, a procedure to obtain total limit curvature of R/C columns is explained and interaction of the flexural damage limit curvature with various design parameters - especially axial load level- are investigated. An equation showing dimensionless damage limit curvature and dimensionless axial load level relationship is derived. The results obtained with the proposed equation are compared with those obtained with the moment-curvature analyses and found to be compatible with experimental results.

Keywords: *Damage limit states, strain limits, moment-curvature, strain hardening, confined concrete*

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Seismic Response of Single Layer Armored Breakwaters†

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ABSTRACT

In conventional two-layer systems various artificial armor units such as tetrapod, dolos, and tribar have been commonly used. Recently, Accropode and Core-loc™ which can be used in a single layer of armoring were recently preferred as armoring. The units for one-layer systems have a high interlocking response under waves and therefore their stability is high. Although response of these units under wave effect is known, their response to seismic action has not so far been investigated. The objective of this study is to investigate the response of breakwaters armored with these units during seismic loadings. An experimental investigation has been carried out for two breakwater models, which consist of a core material and armored with Accropode and Core-loc™ . Both models were placed on a rigid bed. Deformation of the models, relative settlements and damage on the slopes due to the seismic loading are surveyed and compared with each other.

Keywords: *breakwater, single layer, accropode, core-loc™, seismic response*

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Mixed Finite Element Analysis of Composite Plates under Blast Loading†

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ABSTRACT

The dynamic behavior of composite laminated plates under blast loads has been investigated by the mixed finite element method. The change of blast load in time is idealized by using some common functions: i) Step load, ii) N-Pulse, iii) Friedlander function. Also, the effect of geometrical nonlinearity on the period of vibration of the composite laminated plate has been investigated. In the mixed finite element formulation, the nonlinear effects are considered in view of the von Kármán theory. Dynamic analyses are performed with the Newmark method by taking damping into account. In the analyses no condensation is applied to the system matrix and time derivatives of in-plane forces and moments are also calculated.

Keywords: *Mixed finite element method, von Kármán plate theory, dynamic analysis, blast load*

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Comparison of Rock-Socketed Pile Capacities Obtained from Load Testing and Empirical Methods[†]

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ABSTRACT

In this paper, axial bearing capacities of ten rock-socketed piles constructed in Turkey are calculated and compared using load tests and empirical correlations. The load test results are evaluated using suggested approaches from the literature relying on mathematical models proposed for non-failed piles. Empirical correlations typically determine the skin friction and end bearing of piles separately. Generally skin friction governs the capacity of rock-socketed piles until a threshold displacement is reached; after which point the tip resistance has a significant contribution. In this study the most appropriate empirical methods for determining the skin and tip capacities under different conditions are discussed. Furthermore, the limit displacement value for skin friction is examined.

Keywords: *Rock-socketed piles, load capacity, axial load, load tests, empirical methods, displacement, capacity mobilization*

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