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**Abstracting and Indexing**



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**Abstracts of**  
**Acta Technica Napocensis: Civil Engineering & Architecture, Vol. 51, No. 1, 2008**

**PERFORMANCE BASED SEISMIC ANALYSIS OF STEEL FRAMES**

P. Alexa, N. Chira, A. Mathe, I. Ladar

**ABSTRACT**

The contribution presents performance based seismic analysis of frame type steel structures. The provisions of Performance Based Seismic Analysis are introduced and applied to several planar steel frames. The loadings are of push-over type and of accelerogrammes. The beam-column connectivity is of rigid and semi-rigid type. The frames are analyzed in two situations: without and with seismic base isolators. The presented numerical results are: story drifts, base shear - top lateral displacement curves, sequence and locations of plastic hinges. The performed analyses and numerical results exhibit the versatility of Performance based seismic Analysis and the efficiency of such an instrument for the structural designer.

**Keywords:** *performance based analysis, steel frames, push-over analysis, seismic behavior;*

**Full bibliographic reference:**

**FIGHTING THE ENEMIES, A NON-TRADITIONAL APPROACH TO DEVELOPMENT OF CIVIL ENGINEERING STRUCTURES**

P. Alexa

**ABSTRACT**

The contribution intends to present in a non-traditional approach the development of structural engineering as a continuous fighting against the gravitation and earthquake. The paper underlines the continuity of this fighting in the forms of structures, in the structural components that have been there from the beginning, from the oldest ideas of seismic protection of buildings.

The idea of *something old, something new* in structural engineering is many times exhibited through examples of old and new structures. The first part deals with "fighting" against gravity. The structural forms are the best way of defeating gravity. It has been the weapon, in this fight, since the very beginning. Seismic protection is, again not a new idea. Some very old and well known buildings appear to have been seismically protected. Modern techniques (base isolators, viscous dampers, bracing) of seismic protection of both, existing and newly erected, are introduced and some examples are presented for buildings and bridges.

**Keywords:** *gravitation structures, domes, axiality, earthquakes, seismic protection;*

**Full bibliographic reference:**

**SEISMIC PERFORMANCE EVALUATION OF SEMIRIGID STEEL FRAMES**

P. Alexa, A. Mathe, N. Chira, I. Lădar

**ABSTRACT**

The provisions of the new approach of Performance Based Seismic Analysis of structures is shortly introduced and applied to several frame type steel structures. After an introduction into the specificity of semi-rigidly connected steel frames, the structures are analyzed in several situations of loadings (push-over type, time history type) and semi-rigid beam -column connectivity. The numerical results of comparative nature and refer to base shear -lateral top displacement, sequence and locations of plastic hinges. The contribution exhibits and underlines the facility, versatility and utility of Performance Based Seismic Analysis methodology.

**Keywords:** *performance based seismic analysis, semirigidity, steel frames, push-over loading;*

**Full bibliographic reference:**

### **OPTIMUM STRUCTURAL DESIGN USING A STATIC METHOD**

C. Amariei, I.G. Mihai, C.G. Adam

#### **ABSTRACT**

The main objectives of the paper are to present a procedure for optimisation design of structures according to weight criteria and the possibilities of solving this problem by automatic computation. The procedure is based upon inequalities method and allows us to obtain the structural solutions with minimum weight, therefore, finally, a reduction of the material intake and implicitly of the construction price. The mathematical model includes: static equilibrium equations (for loaded bars, kinematic chains and nodes), relations which are expressing plastic yielding conditions (safety conditions) and the weight function which must be made minimum. In case of a linear weight function, simplex method can be used in order to solve the mathematical model, when it becomes necessary the introduction of compensation variables. The paper also includes an illustrative example. The proposed method offers a practical possibility to obtain economical solutions for steel structures.

**Keywords:** *optimum design, minimum weight, inequalities method, linear algorithm;*

**Full bibliographic reference:**

### **CALCULATION METHODS FOR DETERMINING THE RESISTANCE OF STEEL PILLARS SUBJECT TO THE ACTION OF HIGH TEMPERATURES (FIRE)**

A.D.Ancas, D. Gorbanescu

#### **ABSTRACT**

The calculus model proposed for the calculus of the steel post resistance exposed to fire action allows estimation of the final resistance  $N(9)$  of the posts corresponding to a known increase of the temperature or determination of the critical temperature  $9_{cr}$  of the posts subject to an axial effort  $N$  which actions upon the posts during fire. The proposed method can take into account the following aspects: the modification of the mechanic characteristics of steel in high temperature actions, geometrical imperfections of the element, accidental eccentricities of the action at extremities and decrease of sectional dimensions at bending when  $M + N$  take action because is passed over the elasticity limit of the material.

**Keywords:** *fire, elastic characteristics, mechanic characteristics, transfer matrix;*

**Full bibliographic reference:**

### **RESISTANT MOMENT DEVELOPMENTS AT THE MOTION DEVICE OF THE AUTOMOTIVE TECHNOLOGICAL EQUIPMENTS DUE TO THE ROAD IRREGULARITIES**

G. Axinti, A.S. Axinti

#### **ABSTRACT**

In this paper it is presented a method of the rolling way kinematic response evaluation about the equipment on motion, that is simulated as a SDOF system. The kinematics excitation is considered as a harmonical function and produces, to the rolling body axis, a resistant moment characterized by an amplification factor that could acquired a highly values. This work analysis the way which a kinematic excitation influences a traction system dynamic behavior of an automotion equipment.

**Keywords:** *kinematic, excitation, automotion equipment, rolling way;*

**Full bibliographic reference:**

### **ANALYSIS OF REINFORCED CONCRETE ELEMENT UNDER CYCLIC LOADING USING APPLIED ELEMENT METHOD**

C. Baci

#### **ABSTRACT**

Computer simulation is an important key to determine the performance of structures in extreme loading conditions. In order to predict the whole behavior of collapse for structures, the analysis and simulations needs to follow both of

the two stages: a continuum stage first, and a discrete stage. If the finite-element method (FEM), based on rules of continuum mechanics, is suited to the first stage, for the second one the structural designers need new tools: analysis method based on rules of discrete material. A new approach, which is capable of predicting to a higher degree of accuracy the continuum and discrete behavior of structures under extreme loadings, has been developed. The Applied Element Method (AEM) offers the possibility to track the structural collapse behavior passing through all stages of the application of loads: elastic stage, crack initiation and propagation in tension-weak materials, reinforcement yielding, element separation, element collision and collision with the ground and with adjacent structures. The results of the analysis using AEM will be compared to those resulted from the analytical calculus, or from the other type of analysis. The stress - strain relations for different type of structural elements under cycling loads will be also analyzed.

**Keywords:** *cycling loads, crack initiation, yield of reinforcement, concrete crushing, collapse, Applied Element Method, reinforced concrete, computer simulation;*

**Full bibliographic reference:**

### **A STEP BY STEP METHOD TO INTEGRATE THE DIFFERENTIAL EQUATIONS OF THE DYNAMIC RESPONSE. PERFORMANCE OF THE METHOD**

I. Borş

#### **ABSTRACT**

In 1996 I published the paper "A Step by Step Method for Differential Equation Integration. Cauchy Problem (Method of Completing the Initial Conditions)" in the Journal of the Romanian Academy "Revue Romaine des Sciences Technique, serie de Mecanique Appliquée", tome 41, nr. 1-2. In that paper I proposed a numerical method of integrating differential equations for the Cauchy Problem. The Method has been improved as an algorithm and computing software in the meantime. The Method set forth can be applied to integrate nonlinear differential equations exhibiting variable coefficients. The only condition set in non-linearity lies in the "n" order derivative describing the order of the equation as first power. In other words, the equation can admit the normal form. In this way non-linear dynamic response differential equations can be integrated. There one can have coefficients made variable due to an inertial, elastic or dissipative degraded. This paper aims at studying the accuracy and performance of the method mentioned. The accuracy of the numerical method is given by the study of the error and a comparison between the results achieved with analytical methods. The performance of the method becomes obvious when integrating differential equations with known analytical solutions and their domain is seen as very large, even infinite, the solutions are periodical, as it happens with Structural Dynamics Problems. The results of this method lead to the following conclusions: within any period, the values determined by the method set forth are "equal" to the values determined analytically. The equality should be understood within the prescribed tolerance, after more periods, that not deteriorates, there are good results with the integration of equations having poorly conditioned operators. The tests showed that the numerical method proposed by the author of the present paper is valuable in the case of the conditions described. The numerical method has good performance in the integration of any differential equation as a Cauchy Problem as well as in the determination of the structures nonlinear dynamic response.

**Keywords:** *differential equation, numerical method, dynamic response;*

**Full bibliographic reference:**

### **BASE ISOLATION AND DISSIPATION SYSTEMS SUBJECTED TO SEISMIC ACTIONS**

P. Bratu

#### **ABSTRACT**

This paper presents several types of elastic supporting elements intended for base isolation when subjected to seismic actions. Thus, the aspects regarding the dynamic response as well as the present technical solutions certified in Romania by ICECON S.A., are treated.

**Keywords:** *dissipation, seismic action, dynamic rigidity, composite neoprene;*

**Full bibliographic reference:**

### **THE INFLUENCE OF SUDDEN VARIATION OF THE WATER LEVEL IN THE RESERVOIR OVER**

## THE STRAINS OF EARTH DAMS WITH REINFORCED CONCRETE FACE

V. Breaban, S. Gelmambet

### ABSTRACT

This paper has its objective the modelling and the simulation of the behaviour of earth dams with reinforced concrete face under the influence of the sudden variations of the water level in the reservoir. The importance of the nonlinear calculation models is presented in the analysis of the answer of embankment dams. In the work are shown aspects about the resistance of the earth dams and the main factors that influence the stability of the dams. A less researched aspect is presented, the influence of sudden variation of the water level (filling and emptying) of the reservoir. The mechanism of deformation of the dams under variable loads is presented, the hypothesis in witch the analysis is maid, the equilibrium equations and the possible solutions. In the end are presented numerical analysis over Dopca dam, and the results were compared to the results from the measurements. Numerical analysis was done in the hypothesis of the nonlinear behaviour of materials in the dam body, using the Drucker-Prager model with the help of Cosmos 2.6, the finite elements program. Comparing the numeric results with the data taken from the measurements validates the calculation methods and the obtained results. This permits a more exact evaluation of the influence of sudden variations of the water level in the reservoir over the strains, the stability and the behaviour of earth dams with reinforced concrete face. Numerical simulations were done in the hypothesis of sudden filling and emptying of the reservoir. In the ending, following the results obtained are presented a series of conclusions about the influence of the variance of the water level in the reservoir over the strains earth dams with reinforced concrete face. It is seen that in the case of sudden variations the horizontal displacements and deformations are important and can't be ignored. A special problem is the deformation of the reinforced concrete face under the action of sudden variation of the water level in the reservoir. It is seen that the biggest horizontal displacements are registered close to the half of the height of the upstream prism. There fore the biggest deformations will be produced in the central area of the upstream prism surface. Because of these displacements (deformations) modifications of the sections profile appear and even cracks that can endanger the functionality of the dam.

**Keywords:** *strain, stress, earth dams, sudden variation, nonlinearity;*

**Full bibliographic reference:**

## SEA WAVES LOADING DEFINED AS RESPONSE SPECTRUM

V. Breaban, M. Popa

### ABSTRACT

Sea waves have irregular geometrical shapes and varying amplitudes. It is very difficult to make an approximation of the forces they produce on the maritime structures. In this paper, a calculation procedure is proposed, a procedure that allows a quick and simple analysis of the sea waves loadings under the form of dynamic response spectrums. These can be estimated using the registered oscillogrames of the sea waves, that become oscillogrames of the wave pressure on the maritime structure. The dynamic response spectra are estimated using a similar method to that used in earthquake engineering, by solving numerically an integral of Duhamel type. Taking as basis these spectra, the maximal dynamic response could be calculated, modeling the structure as an equivalent system with a single or multiple degrees of freedom. This work contains the results of some numerical examples.

**Keywords:** *wave forces, dynamic loads, response spectrum;*

**Full bibliographic reference:**

## COMPUTER-BASED NONLINEAR ANALYSIS METHOD FOR DESIGN AND SEISMIC PERFORMANCE ASSESMENT OF STEEL AND RC 3D FRAMEWORKS

C.G. Chiorean, G.M. Bărsan

### ABSTRACT

This paper presents an integrated system for advanced structural analysis and seismic performance evaluation of 3D steel and reinforced concrete building frameworks with rigid or flexible connections. The non-linear inelastic static analysis employed herein uses the accuracy of the fibber elements approach for inelastic frame analysis and address its efficiency and modelling shortcomings through the use of only one element to model each physical member of the frame. The proposed software is presented as an efficient, reliable tool ready to be implemented into design practice for advanced analysis and pushover analysis of spatial frame structures.

**Keywords:** *advanced analysis; pushover analysis; nonlinear analysis; 3D frameworks;*  
**Full bibliographic reference:**

### **ABOUT THE PARAMETRIC ANALYSIS OF SOME HYSTERETIC MODELS FOR A SYSTEM SUBJECTED TO SEISMIC MOTIONS**

V.E. Chitan

#### **ABSTRACT**

The present paper is restricted only to some aspects concerning the damping force variation and spectral values response. The simulated excitations comprise accelerograms of some major earthquakes recorded in our country and abroad, which are specific for areas revealing strong tectonic activity. For comparison, a sinusoidal excitation with a reference  $2c/s$  frequency, which was modeled in order to obtain other values of the circular frequency by changing the time scale, has been also included. A research program intended to investigate the dynamic and seismic nonlinear inelastic behavior, useful for reinforced concrete structures acted beyond the elastic limits has been started since 1968 in the Building Research Centre from Iasi. A special attention has been devoted to the hysteretic behavior, to the evolution of energy dissipation in different steps of the time-history.

**Keywords:** *inelastic response, damping factors, equivalence criteria, hysteretic behavior;*  
**Full bibliographic reference:**

### **DEVELOPMENT OF INFORMATION TECHNOLOGY IN CIVIL ENGINEERING**

G. Covatariu, D. Covatariu

#### **ABSTRACT**

Over the last several years we have witnessed an explosion in information generation related to all aspects of life, including all engineering disciplines. There has been an increase in active information collection to be used for solving critical engineering problems. The growing sophistication of computer programs, their availability, increased speed of computations and their ever decreasing costs have already had a significant impact on civil engineering, and that can be considered a paradigm change. New IT technologies for use in civil engineering included stochastic search processes for design space exploration and multiparadigmatic approaches for solving complex multiphysics, multiscale problems, such as simulating the collapse of an imploding building. The IT in CE community must create better, more task appropriate views of complex project information, that involve different interfaces for viewing data; different views such as time, process, output, and resources; and different usage contexts such as in the office and at the workplace. It must be continue to develop distributed systems concepts for collaboration and information sharing, as well as networks of distributed services that facilitate and support customized functionality.

**Keywords:** *information technology, artificial intelligence, neural networks;*  
**Full bibliographic reference:**

### **INCLINED ELASTIC HALF-PLANE ACTED BY A VERTICAL LOAD DISTRIBUTED ALONG THE BOUNDARY**

H.L. Cucu, I. Martian, A.G. Popa

#### **ABSTRACT**

The contribution presents the stresses state of inclined elastic half-plane acted by a continuously distributed vertical load and by the particular-case of uniformly distributed vertical load. The variation of stress state with the slope of the plane and the deepness is also computed.

**Keywords:** ;  
**Full bibliographic reference:**

### **DISASTER MITIGATION - A GENERAL SURVEY**

C. Filip, C. Tudose, V. Breaban

#### **ABSTRACT**

Disaster mitigation refers to all actions that have the purpose of reducing the impact of a disaster that can be taken prior to its occurrence, including preparedness and long-term risk reduction measures. It includes both the planning and implementation of measures to reduce the risks associated with known natural and human-made hazards, and the process of planning for effective response to disasters which do occur. The general purpose is to outline the disaster mitigation concepts and to discuss the range of mitigation actions which can be considered as a response to the variety of natural and human-made hazards which may be encountered. The paper debates the concept of mitigation and briefly surveys the range of hazards which need to be taken into account, describing their nature, consequences and some of the mitigation actions specific to each.

**Keywords:** *disaster, natural hazards, risk reduction, mitigation strategies, vulnerability;*

**Full bibliographic reference:**

#### **ADVANCED TOOLS FOR MACHINERY DESIGNING**

A. M. Goantă

#### **ABSTRACT**

The work proposes itself to emphasize the performances of the three-dimensional generating instruments from AutoDesk Inventor 2008, through geometrically three-dimensional modelling for dynamic study with finite elements of a frontal charger. To the base of three-dimensional modelling was represented by both experience of projecting group from the S. C. Promex SA. firm and the teachers from the Research Centre for Mechanics of the Machines and Technological Equipments. As well as the work emphasized the performances of modelled three-dimensional comparative to another software competition, to the last version of AutoDesk Inventor the 2008 version.

**Keywords:** *CAD;*

**Full bibliographic reference:**

#### **STRUCTURAL DYNAMIC ANALYSIS OF TALL LIGHT STRUCTURES**

L. Kopenetz, A. Cătărig

#### **ABSTRACT**

The introduction of the bearing structures with cables and membranes having complex tall forms into the construction practice, was an important stage in the rational management of the human and material means, so that they lead to optimum economical results. Starting from this finding the present paper approaches and solves, in a unitary manner, the problem of structural dynamic analysis of the bearing structures with cables, considered in its most general sense (cables, membranes with fibres or incorporated cables, double hinged members). It presents the unitary formulation of the structural analysis, on the basis of FEM, using LAGRANGIAN coordinates and PIOLA-KIRCHHOFF strains, as well as SUM01 computer program, in the most general configuration. Besides the mathematical models, numerical methods and computer program, the paper presents some practical and experimental methods of calculation.

**Keywords:** *structural dynamic, light structures, numerical stability;*

**Full bibliographic reference:**

#### **IMPLEMENTATION OF INTELLIGENT CONTROL SYSTEMS FOR BEARING STRUCTURE ASSESSMENT IN SEISMIC AREAS USING FUZZY LOGIC**

L. Kopenetz, D.F. Lisman

#### **ABSTRACT**

By the assessment of bearing structures located in areas with high seismic risk, there are raising problems with an increased complexity, due to the large number of random variables involved in the computations. The generalization of the analysis of bearing structures, using information carrying technological systems, imposes more and more the problem of prioritizing the decisions during the structural analysis process. Thus, fuzzy logic based reasoning can be successfully used on large structural systems, where the human factor (the expert) plays a fundamental role during the decision making process. In this paper, the authors discuss the aspects of fuzzy reasoning used in the structural assessment of bearing structures in seismic areas, starting from degradation functions and dynamical identification



concepts of structures and finishing with the safety assessment of a complex structure, using a rule-based inference engine. The computational program is implemented using C programming language, being designed in a way that allows the continuous development of the knowledge base, with new elements.

**Keywords:** *bearing structures, assessment, fuzzy logic, uncertainties;*

**Full bibliographic reference:**

### **MAJOR HISTORICAL EARTHQUAKES IN ROMANIA**

D. Lungu, A. Aldea, C. Arion, R. Vacareanu

#### **ABSTRACT**

The paper presents a synthesis of available information on major historical earthquakes in Romania, focusing on Vrancea source. The Vrancea intermediate depth source is a source of strong subcrustal seismic activity, which affects more than 2/3 of the territory of Romania and an important part of the territories of Republic of Moldova, Bulgaria and Ukraine. During centuries, it was felt on an area of more than 2 mill. km<sup>2</sup> in Europe, including that of the neighbouring countries of Romania as well as Austria, Russia, Greece and Turkey. The papers end with elements on the evolution of Romanian design codes and seismic zonation.

**Keywords:** *earthquakes, Vrancea, Romania, damage, codes;*

**Full bibliographic reference:**

### **NATIONAL AND INTERNATIONAL PROGRAMS FOR REDUCTION OF SEISMIC RISK IN ROMANIA**

D. Lungu, R. Vacareanu, A. Aldea, C. Arion

#### **ABSTRACT**

The paper presents the synergy between national programs and international projects for seismic risk reduction: JICA Project "Seismic Risk Reduction for Building and Structures in Romania" (2002-2008), World Bank Hazard Risk Mitigation and Emergency Preparedness Project in Romania (2004-2009) - Component B: Earthquake Risk Reduction, RISK-UE Project "An advanced approach to earthquake risk scenarios with application to 7 European towns" (2001-2004) and European Project PROHITECH "Earthquake Protection of Historical Buildings by Reversible Mixed Technologies" (2004-2008), SFB461 - "Strong Earthquakes: A Challenge for Geosciences and Civil Engineering" (1996-2007), NATO project entitled "Harmonization of Seismic Hazard Risk and Reduction in Countries Influenced by Vrancea Earthquakes (2005-2008)".

**Keywords:** *risk, earthquake, JICA, NCSRR, World Bank, European Commission;*

**Full bibliographic reference:**

### **MECHANISMS OF RC ELEMENTS DESTRUCTION UNDER EXPLOSIVE DETONATION**

M. Lupoae

#### **ABSTRACT**

The behaviour of reinforced concrete structural elements subjected to explosive charge detonation is presented. The explosive charge was placed in blastholes that were performed on reinforced concrete elements. There were used four explosive types: TNT, mixture of AN and TNT, EPH (an explosive composition based on RDX), and EPP (an explosive composition based on PETN). Reinforced concrete elements used were beams, lintels and slabs. There were tested different combinations of concrete element, explosive charge types, amounts of explosive, number and position of blastholes.

**Keywords:** *detonation, demolition, explosive, reinforced concrete element, destruction;*

**Full bibliographic reference:**

### **UTILIZATION OF CONVEYANCE MATRICES IN CALCULATION OF THIN WALLED STRAIGHT BARS**

I. Martian, H.L. Cucu, A.G. Popa

#### **ABSTRACT**

The present paper introduces the computation of thin walled bars with open sections in prevented/restrained torsion using transfer matrices under any loading type or end conditions. The method applies simply and it is automatically performed.

**Keywords:** *thin walled bar, prevented torsion, conveyance matrices, transfer matrices;*

**Full bibliographic reference:**

#### **NUMERICAL STUDIES ON STEEL FRAME STRUCTURES RETROFITTED WITH EARTHQUAKE PROTECTIVE SYSTEMS**

H. Mociran, A. Stan

#### **ABSTRACT**

This paper provides a comparison of the performance indices of a six storey building with three different structural systems - moment frame, viscously damped frame and a base isolated frame. Fluid viscous damping and base isolation have the same objective of significantly decreasing the response of a structure to earthquake excitation. With both fluid viscous damping and base isolation it is possible to have a structure remain within the elastic region, so there is no permanent deformation from a seismic event. Each of the models were analyzed as linear structures and subjected to time histories for 3 different artificial earthquakes of Vrancea type. The non-dimensional performance indices considered for the models are: Peak Drift ratio, Peak Base Shear and Peak Level Acceleration. In summary, the viscously damped frame has the best overall relative performance of the three framing schemes. The base isolated frame is better than moment frame.

**Keywords:** steel frames, seismic performances, viscous dampers, base isolators;

**Full bibliographic reference:**

#### **APPLICATION OF THE GENERALIZED BEAM THEORY**

M. Nedelcu

#### **ABSTRACT**

The paper is a presentation of a relatively new and unknown theory developed by R. Schardt in 1989 and designated as Generalized Beam Theory. GBT has many advantages: it gives a general representation of the four main beam phenomena: extension, bending according to the first/second main axis and torsion. Using the same representation, GBT is also capable to analyse the cross-section deformation phenomena. GBT is the only known method capable to produce pure modes of deformation and to evaluate the effect of each one on the total deformation configuration. This feature is extremely useful for the buckling analysis of thin-walled bars. The paper also presents a computer program based on GBT which presently is able to calculate for any double-hinged thin-walled bar with open, single-branch section, under transversal uniformly distributed loads: the orthogonal modes of deformation, the uncoupled tensions and strains coming from each phenomenon (the four beam phenomena and also the cross-section deformation).

**Keywords:** *Generalized Beam Theory, thin-walled bars, warping, eigen value problem, orthogonal;*

**Full bibliographic reference:**

#### **LOCAL ELASTIC SYSTEM FOR PROTECTION AGAINST HYDRAULIC SHOCK**

C.Ş. Niţescu, D.I. Arsenie, M. Florea, I. Omer, M. Stănescu

#### **ABSTRACT**

The unsteady regime behaviour of the flow in the hydraulic pressure systems may become a dangerous phenomenon for a hydraulic installation under certain circumstances. The fast variable movement known also as hydraulic shock or water hammer may induce in the hydraulic system overpressure that may outpass many times, even tens of times, the normal permanent pressure or it may induce pressures that may go down under the limits of the cavitation. The specific design of hydraulic pressure installations (gravitational or pumping ducts) so that they can resist to such pressure variations may be considered sometimes a completely uneconomic solution, especially when large size installations (in length and width) are concerned. Therefore, the hydraulic pressure machineries are protected against the dangerous effects of hydraulic shock. At the moment, the most efficient solutions for this kind of protection are

considered to be the surge tank and the air-chamber. The greater is the size of such a device and the lower is the hydraulic resistance of the branch pipe, the stronger is the effect of transformation of the unsteady regime fast variable movement into slow variable movement (mass oscillation). Therefore, the provided protection is more efficient but simultaneously the cost of such a device rises. Both these protection solutions have a high cost, and, in addition to this, the air chamber has also the disadvantage of a more exacting operating system regarding the maintenance of the water level and of the pressure inside the air chamber within the proper (optimum) limits.

**Keywords:** *water hammer, elastic system, unsteady regime, cavitation.*

**Full bibliographic reference:**

## **ANALYTICAL AND NUMERICAL STUDY OF VARIABLE ORIFICE DAMPERS FOR SEISMIC PROTECTION OF STRUCTURES**

C. Pastia, S.G. Luca, F. Luca

### **ABSTRACT**

The seismic protection is, without any doubt, a worldwide priority, and that is why one of the main preoccupations of the researchers in the field is finding some innovative concepts concerning the seismic protection of the structures. The scope of the paper consists in the analytical and numerical study of the variable orifice dampers implemented in the structures of the buildings in order to increase people's safety and reduce the seismic risk. The variable orifice damper is the common semi-active hydraulic device which may be utilized as part of seismic isolation system or within the lateral bracing of a structure. The semi-active control strategy is realized using on-off clipping control algorithm. It is concluded that, the variable orifice damper afforded a substantial reduction of the displacement response of a SDOF system in comparison to the response with passive control fluid device.

**Keywords:** *structural control, earthquake engineering, dynamic model, control device, damping;*

**Full bibliographic reference:**

## **SINGLE CURVED SANDWICH SHELLS**

A. Poanta

### **ABSTRACT**

As pointed out by Plantema [1], surprisingly little has been written on the theory and application of bending of sandwich shells. It seems that most effort has been spent on buckling of cylindrical shells. In this paper, equations are developed for an orthotropic sandwich plate with a constant cylindrical curvature. The derivation follows the work by Stein and Mayers [2,3] and is restricted to plates of constant thickness with orthotropic material characteristics and a single cylindrical curvature with a radius of curvature much greater than the thickness of the plate. The derived equations can, of course, be extended to be valid for a plate with constant double curvature. There exists a more refined but similar theory that accounts for thick faces as described by Fulton [4] based on the same approach as outlined here, but in most practical cases the thin face approach will suffice. Solutions to some simple cases of uniaxial buckling of isotropic sandwich cylinders and buckling due to external pressure [1] are given herein. In [1] one may find much further information on the topic, such as buckling of orthotropic shells, buckling due to torsion, buckling of circular cylindrical shells, and buckling of spherical shells.

**Keywords:** *sandwich, orthotropic, stiffness;*

**Full bibliographic reference:**

## **EARTHQUAKE ISOLATORS FOR LOW-RISE BUILDINGS AND MODERATE SEISMICITY**

A. Pocanschi, M.C. Phocas

### **ABSTRACT**

Structural control through base isolation has been increasingly implemented in the last years and has proven to be a most promising strategy for earthquake safety of the structures. This paper presents prototype developments of adaptable earthquake isolators that satisfy in a compact device the requirements of rigidity, damping, elasticity and stability according to the loading conditions. The isolators consist of an elastomeric bearing formed as a ring or several columns, coupled with a glass-fibre epoxy resin ball, which is embedded in concave elastomeric pillows, meeting thus all previously mentioned mechanical requirements in a single unit. The devices aim at applications

with low vertical loads (low-rise buildings), whereby conventional laminated elastomeric bearings are difficult to adjust satisfactorily. In this paper the isolators set-up, as well as the dynamic testing results of the prototypes under different vertical loads and loading frequency are presented. The aim of the study is to evaluate the results obtained from the dynamic loading tests, in terms of deriving the linear equivalent properties of the isolators. With the obtained parameters, a preliminary verification of the isolators effectiveness is conducted under selected Greek earthquakes.

**Keywords:** *structural control, base isolation, hysteretic behavior, seismic performance;*

**Full bibliographic reference:**

### **COMPARATIVE STUDY REGARDING THE DESIGN OF STEEL STRENGTH MEMBERS AFTER STAS 10107/0-78 AND EUROCODE 3**

A.G. Popa, H.L. Cucu, I. Martian

#### **ABSTRACT**

The alignment of the Romanian normatives to the European codes (Euro codes) raises for the structural engineers new aspects related to the design and execution of the buildings. The paper proposes a parallel investigation of the Romanian design code for steel structures (STAS 10107/0-78) and Eurocode 3 (SR EN 1993-1-1:2006 Design of steel structures). The first part of the paper consists in a comparative analysis regarding the basis of design after the two codes with emphasis on the particularities related to the structural modeling and basic assumptions. The theoretical aspects are followed by a numerical example. The elements of a steel frame are checked after two codes and the results are interrelated with respect to the efficiency and safety criteria.

**Keywords:** *steel structures, design of steel members, Eurocode 3, STAS 10108/0-78;*

**Full bibliographic reference:**

### **THE SEISMIC PERFORMANCE EVALUATION OF DIFFERENT CLASSES OF REINFORCED CONCRETE STRUCTURES USING NONDETERMINISTIC MODELS OF THE SEISMIC ACTION**

B.F. Popa, G.M. Atanasiu

#### **ABSTRACT**

The paper's objectives are to analyze and evaluate the seismic performance of different classes of reinforced concrete structures on Iasi site using probabilistic models of the strongest earthquakes from Vrancea area, Romania (March 4th 1977, August 31st 1986 and May 30th 1990).

The methodology used to analyze the seismic performance of the analytical models described in the paper is based on the static pushover analysis and on the seismic hazard analysis using earthquake probabilistic models. The analysis goal is to determine the seismic performance levels of the models by determining the pushover curves (P-A) and to identify the corresponding levels of the limit states associated with earthquakes having different exceedance probabilities, according to the Romanian Seismic Design Code P100-1/2006 [1] and American pre-standards FEMA 274 [2] and FEMA 356 [3].

**Keywords:** *seismic, performance, design, reinforced concrete, probabilistic, static pushover.*

**Full bibliographic reference:**

### **CONTRIBUTION TO ERROR ESTIMATES FOR PLATES**

A. Stan, H. Mociran

#### **ABSTRACT**

This paper discusses the formulation of the Reissner-Mindlin[1] thick plates modeled using the first order shear-deformation theory[1]. The order of convergence is being discussed for uniform meshes of linear quadrilateral elements. Numerical results are presented and the problem of thin plates is presented.

**Keywords:** *a posteriori, error estimates, plates, Reissner-Mindlin;*

**Full bibliographic reference:**

### **MODELINGS ON MITIGATION OF POUNDING BY MEANS OF CONNECTION BETWEEN**

## **BUILDINGS**

D. Stoica, S. Majewski

### **ABSTRACT**

Pounding introduces impact loads that have to be superimposed on those caused by the ground acceleration itself. When these impact loads from pounding are too high, the structural system has to be modified to reduce the response. Several methods have been proposed to avoid pounding induced collapse of buildings. The methods may be classified according to their approach to the problem of pounding: methods to avoid pounding, methods to strengthen structures to withstand pounding, and techniques to reduce pounding effects in the structures.

**Keywords:** *pounding, mitigation, connection, Eurocode 8;*

**Full bibliographic reference:**

## **IDENTIFICATION METHODS OF THE NONLINEAR SYSTEMS SUBJECTED TO SEISMIC ACTIONS**

D. Stefan, V.E. Chitan, G. Covatariu

### **ABSTRACT**

The need to identify the nonlinear systems subjected to stochastic actions led to the development of the classical and/or deterministic methods toward some methods capable to take into account the improved models for structure and excitation. The identification of the nonlinear systems can be carried out using specific approaches that are based on the reparability hypotheses or on the change of the nonlinear system with an equivalent linear system that has the features closely related to the initial one. Current nonlinearities that occur in the structural response during a strong earthquake are geometrical and/or physical (nonlinearity of the stiffness and the damping). In order to underline the nonlinearity of the stiffness, in this paper we take advantage of the modelling method for the structural response using a non-stationary linear model and the parameter identification of the equivalent stationary linear model, both for the SDOF and the NDOF systems. Explaining the nonlinearity of the stiffness can be done in two specific ways: the structure response modelling through the nonstationary linear model and the parameter identification of the equivalent stationary linear model; the real stiffness valuation of the structure during each vibration cycle using the internal force calculus of the structure.

**Keywords:** *nonlinear system, stationary linear model, nonlinearity of the stiffness, structural response;*

**Full bibliographic reference:**

## **SOME CONSIDERATIONS ABOUT THE ESTIMATE DEVELOPMENT OF THE SEISMIC FORCE, IN ROMANIAN DESIGNING CODES**

D. Stefan, G. Covatariu

### **ABSTRACT**

The seismic calculus researches in the past 50 years also based on experimental recordings are led to changes in the building design standards. Major changes were made in estimating the dynamic amplification coefficient which is established in relation to the spectral composition of the seismic movements generated by the Vrancea source and in relation with the reduction coefficient  $\gamma$ , which accounts for the ductility of the structure. This paper aims evolution of global seismic coefficient for 3 types of structures situated in Iasi and Bucharest. By analyzing the results of the seismic force calculus according to the present standards one can notice the major increase of the seismic force value according to the P100-2006 Standard, in comparison with the former ones. Seismic force values representing 40-60% of the seismic force according to P100-2006 for various types of buildings designed in period 1963-1992 can be alarming if we think about the number of buildings are made in this time interval.

**Keywords:** *building design standards, global seismic coefficient, seismic force.*

**Full bibliographic reference:**

## **SEISMIC REHABILITATION OF A REINFORCED CONCRETE FRAMED STRUCTURE BY THE USE OF TUNED MASS DAMPERS AND VISCOUS DAMPERS**

E. Tulei, D. Cretu, C. Ghindea

### **ABSTRACT**

The paper presents two modern rehabilitation methods of a five storey reinforced concrete framed structure built in Bucharest in 1965. The first method consists in placing tuned mass dampers on the roof floor. In the second method, viscous dampers are attached to steel braces placed on the diagonal of the panels from the lateral spans of the building. The structural response obtained when these two methods are applied, is compared with the structural response obtained in the traditional strengthening solution, which consists in building reinforced concrete walls that work together with the framed structure by means of chemical anchors. The study shows that each dissipative device has a certain destination and has to be designed according to the structural system, soil conditions, earthquake type and the required performance level.

**Keywords:** *structural control, tuned mass damper, viscous damper;*

**Full bibliographic reference:**

## **SEISMIC BEHAVIOR OF ANCIENT COLUMNS**

I. Vayas, M.-E. Dasiou

### **ABSTRACT**

Columns of ancient temples (Greek and Roman) consist of accurately fitted blocks, which lie one upon another, in total absence of binding agents like mortar. In contrast to modern structures that dissipate significant amount of energy through inelastic behavior, the dynamic behavior of the ancient columns is ruled by the independent rocking and sliding of the drums that during a strong earthquake creates an external energy absorption mechanism. Due to the highly non-linear behavior, an analytical approach is almost impossible for such type of structures. The most appropriate way to investigate the problem is by means of numerical methods. However, verification and calibration of the main parameters, especially the joint properties, is necessary, before such a numerical method can be used in the restoration process of a classical monument. This paper presents three alternative modeling methods that are used by application of the general purpose codes ABAQUS and 3DEC. The suitability of the methods is examined by comparing the numerical results with corresponding experimental ones, as obtained from shaking table tests on identical freestanding columns.

**Keywords:** *earthquake response, multi-drum column, finite and discrete element method, rocking and sliding.*

**Full bibliographic reference:**

## **ABOUT ANALYSIS OF MULTILAYERED PLATES BY USING THE FINITE ELEMENT METHOD**

M. Vrabie, N. Ungureanu

### **ABSTRACT**

In the paper are developed some finite element techniques referring to multilayered plate systems. The multilayered plates, more frequently used in practice, are still not enough studied from structural design point of view. There are considered thin plates made from  $m$  isotropic and homogeneous layers having different Young's moduli and the same Poisson's ratio. The deformation continuity and the normal line element assumption (Kirchhoff - Love theory) are adopted as a consequence of the perfect adhesion between layers and also of the plate's small thickness in comparison to the dimensions of the plate in its own plane. Starting from kinematic strain-displacements relations, the constitutive equations and the internal forces relations are adjusted. For analysis by finite element method, the neutral surface of the plate are divided into rectangular finite elements with four nodes and three degree of freedom per nod. The displacement fields for these finite elements will be approximated by polynomials and, as an alternative, isoparametric functions. The stiffness matrix are determined and the obtained results are discussed. The proposed method leads to solutions similar with those obtained for homogeneous isotropic or orthotropic plates, and the results may be compared. The global internal forces and moments will be no more different from those obtained in the case of plates with different Poisson's ratios. There are some local modifications of the stresses.

**Keywords:** *multilayered plates, finite element method, displacement field, stiffness matrix;*

**Full bibliographic reference:**

## **EXPERIMENTAL RESEARCH OF A STEEL JOINT TO CONNECT THIN-WALLED STEEL PROFILES**

M. Budescu, I. Ciongradi, O. Rosca

### **ABSTRACT**

The results and conclusions regarding the experimental tests of the joint assembly of thin walled steel profiles with and without strengthening elements (stiffeners) are presented. The KONTIBEAM constructive system basically is composed of a pair of galvanized thin sheet profiles so denominated as KB, which are joined by means of steel sheets, (usually of 10 mm thickness), placed in-between them. The connection of this assembly (KB's and connectors) is realized by using M20 bolts put in ( $p22$  holes, which work in friction with two contact planes. The tested joints are connected by the means of 8.8 class HSFSG bolts (High Strength Friction Grip). The entire test series have been performed using the 5 mm thick KB600 thin-walled profiles and 3.5 mm thick KB450. In the paper there are presented the joints connecting the KB450-3.5 steel profiles. The main conclusions of the tests are that the contour bolted connections assure a good behavior between the KB profiles and the joint element. Due to their position the strengthening elements lead to an increase of the bearing capacity up to 30... 35% with respect to the yield limit of the KB material. The use of such strengthening elements allows the optimum use of the KB profiles, thus leading to the reduction of the material consumption.

**Keywords:** *steel joints, thin-walled steel profiles, experimental testing;*

**Full bibliographic reference:**

### **SOME ASPECTS REGARDING THE DESIGN OF FILLET WELD CONNECTIONS ACCORDING TO EUROCODE 3/2003 AND THE ROMANIAN STANDARDS 10108/0-78**

C. Câmpian

#### **ABSTRACT**

The paper presents some aspects on welded connection that is, in the present days, the most used connection method for steel buildings. The main design criteria according to Eurocode 3/2003 face to the same criteria from the Romania Standard 10108/0-78 is presented. The discussion is made for the fillet welds. The last part of the paper is devoted to differences between the two standards and to the conclusions on the calculus of the welded connections, as well as to the bibliography.

**Keywords:** *welding, fillet welds, butt welds, standards;*

**Full bibliographic reference:**

### **FINITE ELEMENT MODEL FOR COMPOSITE STEEL-CONCRETE COLUMN**

C. Câmpian, C. Moga

#### **ABSTRACT**

In Technical University of Cluj Laboratory, several tests according to ECCS loading procedure were carried out. The tested specimens were composite columns of fully encased type subject to a variable transverse load at one end while keeping a constant value of the axial compression force into them. The complex evolution of the curves representing the transverse force versus the associated displacement up to a pronounced deterioration of the column bases leads to an analytical simulation in finite elements program. A comparison is made and several conclusions end the presentation.

**Keywords:** *composite steel-concrete columns, transverse load, finite elements;*

**Full bibliographic reference:**

### **COMPARATIVE STUDY OF EXPERIMENTAL PROGRAM AND NUMERICAL APPLICATION FOR COMPOSITE STEEL-CONCRETE COLUMN**

C. Campian, V. Pacurar, C. Moga, G. Urian

#### **ABSTRACT**

In order to acquire a numeric comparison of the capable bending moment obtained according to EC4 norm relative to real composite columns behavior, several experimental and numerical applications were made. The type of composite column investigated in the present paper is a steel profile fully encased in reinforced concrete section. The strengthening of the column due to concrete encasement is clear when the column is subject to static and dynamic loading. The tested composite columns were subject to a variable transverse load at one end while keeping a constant value of the axial compression force into them. A possible approach to investigate better the column seismic performances is illustrated in this paper going from a basic experimental research to numerical application

of EUROCODE 4.

**Keywords:** *composite columns, fully encased steel profiles in concrete, axial compression and uniaxial bending.*

**Full bibliographic reference:**

### **PERFORMANCES OF SHEAR CONNECTORS UNDER CYCLIC LOADING**

A. Ciutina, A. Dogariu

#### **ABSTRACT**

The behaviour of steel frames with connection of the steel beam with the concrete slab depends largely upon the connection between the steel and concrete elements. The Eurocode 4 presents an experimental based procedure for designing the shear connection between the steel and concrete, based on standard push-out tests. However, in the seismic regions, the tests should be of push-pull type as the seismic loading could be cyclic, for example in the main composite beams of moment-resisting frames. The paper presents the results of several laboratory tests on standard push-out specimens, on which there have been tested various types of connectors.

**Keywords:** *shear connectors, ductility, failure mode, resistance;*

**Full bibliographic reference:**

### **THEORETICAL AND EXPERIMENTAL STUDIES ON WELDED COMPOSITE JOINTS FOR BUILDINGS PLACED IN SEISMIC AREAS**

D. Dan, V. Stoian, T. Nagy, C. Dăescu, C. Floruț

#### **ABSTRACT**

In the last period the interest for multi-storey buildings increased due to the development of cities around the world. In fact the price of land increased so much as the investors want to build tall buildings in a small areas. The general behaviour of the tall buildings is analysed using dedicated software but many times the particular elements must be studied in experimental laboratories. At the „Politehnica” University of Timisoara, it was developed a theoretical and an experimental program for a specific steel and composite (steel-concrete) joint, used for a multi-storey building. The testing specimens were designed both for the structural steel and the composite joint. The calibration of the experimental elements was performed in the elastic and post-elastic range using numerical analysis. The main objective of the studies was to observe and evaluate the behaviour and the failure mode for steel and composite joint. Two load hypotheses on the joint were considered: symmetrical and asymmetrical. The paper contains a comparative study between the theoretical and experimental results obtained on the behaviour of the structural steel and steel-concrete composite joint.

**Keywords:** *numerical analysis, composite joint, post elastic behaviour, experimental tests;*

**Full bibliographic reference:**

### **SEISMIC UPGRADING OF REINFORCED CONCRETE MOMENT RESISTING FRAME WITH DISSIPATIVE BUCKLING RESTRAINED STEEL BRACES**

D. Dubina, S. Bordea, A. Stratan

#### **ABSTRACT**

This paper presents the structural analysis of strengthening a reinforced concrete (RC) frame gravity load designed (GLD) according to 50 years old Romanian standards. The design of the RC frame is followed by the structural analysis of the same frame strengthened by means of two methods. The first strengthening method is using a dissipative system represented by a buckling restrained braces (BRB) system applied in the middle spans of the frame as an inverted V system, pinned at the ends. The second method of strengthening is the confining of the columns, from the first two stories, by means of fabric reinforced polymers (FRP) techniques. In the first step the two methods are applied and analysed separately on the frame, then a combination of them is applied and analysed.

**Keywords:** *buckling restrained braces, fiber reinforced polymers, gravity load design, reinforced concrete frame, upgrading;*

**Full bibliographic reference:**



## PERFORMANCE BASED ANALYSIS OF HIGH STRENGTH STEEL BUILDING FRAMES UNDER SEISMIC ACTIONS

D. Dubina, F. Dinu, A. Stratan

### ABSTRACT

High strength steels - HSS with yield stress of 420-690 MPa have been available for many years. There are many applications of HSS in bridge constructions, but only a few in building constructions. In seismic design, steel building frames are designed as dissipative structures and plastic deformations are allowed to develop in specific members. The members designed to remain in elastic range during the earthquake, as the columns in multi-storey frames, are usually characterized by high over strength demand. For such kind of members, the use of HSS represents a real and effective opportunity. In order to get an economic design of the structure is necessary to keep the stresses quite low in the dissipative members and therefore to reduce the demand in the non-dissipative members. Such a solution has been recently applied by authors to the design of a 26 storey steel building frame in Bucharest, where lower yield strength steel was used for the dissipative braces in the CBFs. If this option is not possible, the alternative is to increase the strength of the non-dissipative members by using heavier sections or by using higher yield strength steel. For MRF structures, first option is recommended, as this will lead to an increase of the stiffness, which in many cases is critical in the seismic design, but for braced structures or for dual structures, this will lead to a stress concentration in the non-dissipative members (i.e. columns). For these structures, the adoption of high strength steel in the non-dissipative members (e.g. to remain in elastic range during the earthquake) seems to be more likely. A parametric study was developed on these frame typologies, based on time-history analysis in order to explore the opportunity and effectiveness of using HSS in seismic resistant building frames.

**Keywords:** *seismic performance, high strength steel, braced frames;*

**Full bibliographic reference:**

## PERFORMANCE OF MOMENT RESISTING JOINTS OF HIGH STRENGTH STEEL COMPONENTS

D. Dubina, N. Muntean, A. Stratan, D. Grecea, R. Zaharia

### ABSTRACT

Multi-storey steel buildings in seismic areas are assigned to one of the following structural types, depending to the behaviour of their lateral force resisting systems:

- Moment Resisting Frames (MRF), in which the horizontal forces are mainly resisted by members acting in an essentially flexural manner;
- MRF +Centrically Braced Frames (CBF), in which the horizontal forces are mainly resisted by members subjected to axial forces;
- MRF+ Eccentrically Braced Frames (EBF), in which the horizontal forces are mainly resisted by axially loaded members, but where the eccentricity of the layout is such that energy can be dissipated in seismic links by means of either cyclic bending or cyclic shear.

Each of these structural systems dissipates a part of the seismic energy imparted in the structure through plastic deformations in the dissipative zones of the ductile members (i.e. beams in MRF, links in EBF or braces in CBF). Other members should respond predominantly in elastic range. To be able to provide by design a reliable control of structural control during earthquake, the basic idea is to use Mild Carbon Steel (S235, S275, S355) in dissipative members (e.g. beams in MRF, braces in CBF, links in EBF), and High Strength Steel (S460, S690) in non-dissipative members. The robustness of structures to severe seismic action is ensured by their global performance, in terms of ductility, stiffness and strength, i.e. the "plastic" members will dissipate the seismic energy, acting like structural fuses, while the "elastic" members, provided with relevant overstrength, by higher resistance of material and appropriate size of sections, will have the capacity to carry the supplementary stresses, following the redistribution of forces, after appearance of plastic hinges. For all structural systems the performance of Moment Beam-to -Column systems is crucial. On the purpose to evaluate the characteristics of these joints, when different steel grade components are connected, a large experimental programme, including welding details, T-stubs and MR joints is presented in this paper.

**Keywords:** *dual steel connection, high strength steel, monotonic, cyclic loading;*

**Full bibliographic reference:**

## STRUCTURAL PERFORMANCE OF PITCHED ROOF COLD-FORMED STEEL FRAMES OF BOLTED

## **JOINTS**

D. Dubina, V. Ungureanu, A. Stratan, Zs. Nagy

### **ABSTRACT**

The paper summarizes the results of the experimental and numerical simulation program carried out on full-scale pitched roof cold-formed steel portal frames of back-to-back lipped channel sections and bolted joints in order to evaluate their structural performance and to find an adequate design methodology. A procedure to evaluate the ultimate design capacity of these frames is proposed. In case of no laterally restrained frames, the General Method in EN1993-1.1 for lateral and lateral-torsional buckling for beams and beam-columns can be incorporated in that procedure.

**Keywords:** *pitch roof portal frames, thin-walled cold-formed steel members, bolted joints, full-scale test, general method of EN1993-1.1;*

**Full bibliographic reference:**

## **GENERAL APPROACH TO CALIBRATE AND VALIDATE BUCKLING CURVES BASED ON AYRTON-PERRY MODELS**

M. Georgescu

### **ABSTRACT**

A unified procedure built to calibrate (a) generalized imperfection factor used in the Ayrton-Perry equation of the European buckling curves is presented by the author. This procedure is valid for hot rolled, welded or thin-walled cold-formed steel members, either in compression or in pure bending. A review of subsequent design models and present cross section classifications prescribed by Eurocode 3 is thus possible. Relevant results obtained by practical application of the procedure on Ayrton Perry models are presented.

**Keywords:** *lateral-torsional buckling, buckling curves, imperfections, coupled instabilities, generalized imperfection factor, experimental results;*

**Full bibliographic reference:**

## **THE BEHAVIOR OF A STEEL BAR IN POST CRITICAL DOMAIN AND ALTERNATING SEISMIC LOADS**

O. Gosa

### **ABSTRACT**

The paper presents aspects of an investigation made upon the behavior of an element of steel bar E1 from the diagonal of stiffen in a one floor industrial hall. The bar was submitted in a stand at to the cycles of compression-stretch like a diagonal from in reality induced a diagonal from an usual portal in K, acted by horizontal forces of seismic type. After two cycles in the elastic domain at compression-stretch, in the third cycle has been reached the lost of stability. The bar was initially deformed symmetrically with the deflection at the middle of the opening, after which has moved at the approximately 1/3 of the articulated part of the bar forming the plastic joint. E<sub>1</sub> bar subjected to compression-stretch can be assimilated with a dissipative system (dissipation of the energy by plastic deformation) in which appear bifurcation phenomenon of the equilibrium in cascade. The force level at which the bar fails by buckling after the first cycle of compression-stretch can be determined by the mode proposed by the author.

**Keywords:** *steel structure, post critical behavior of a bar, seismic loading, alternating compression -stretch stress;*

**Full bibliographic reference:**

## **COMPOSITE COLUMNS OF PARTIALLY ENCASED STEEL SECTIONS**

C. Moga, S. I. Gutiu, G.Urian

### **ABSTRACT**

A constructive solution of composite columns is that of being built-up as concrete partially encased double T or H steel profiles. In a comparative study the resistance of a column subjected to axial compression is analyzed. The initial section of the column is of steel profile HE 44 B which is transformed in a composite column in solution of

concrete partially encased steel section. By analyzing the obtained results some useful observations for the design of such members are made.

**Keywords:** *composite columns, concrete partially encased steel profiles, axial compression;*

**Full bibliographic reference:**

#### **COMMENT CONCERNING THE DESIGN OF COMPOSITE COLUMNS IN ACCORDANCE WITH EC 4**

V. Pacurar, C. Moga, C. Campian

##### **ABSTRACT**

During the Eurocode 4 elaboration a lot of work-shops, conferences congresses and meetings took place and some design relations changes, simplifications and improvement of the design methodology have been produced and the process is unfolded nowadays. This paper presents some of these changes and the influence of the parameter  $u$ . on the load carrying capacity of the composite steel-concrete column subjected to compression and bending.

**Keywords:** *composite steel-concrete column, compression, bending, Eurocode 4;*

**Full bibliographic reference:**

#### **COMPARATIVE STUDY REGARDING THE USE OF STEEL AND WOOD FOR AN INDUSTRIAL BUILDING**

P.Pernes, C. Campian

##### **ABSTRACT**

The concept of steel structural system is largely influenced by some particularities of structural steel as a material and of the behavior of the structural members. As a result, steel design is based on its own structural philosophy, which presents some particularities in comparison with the concept of structural systems in reinforced concrete, brick or timber. The three examples of roof systems for an industrial single storey building, which are shown on below are located in Romania, in snow regions: a timber elements structure, a cold-formed elements structure and a hot-rolled shapes member structure. A comparison regarding the use of these three different types is made, from the point of view of an investor, not taking very much in account the specific design problems .

**Keywords:** ;

**Full bibliographic reference:**

#### **DEFFICIENCIES OF A LARGE SPAN METALLIC CONSTRUCTION**

A. Puskas, A. Bacso

##### **ABSTRACT**

The paper presents the design process, its restraints and the problems appeared after the erection of a steel construction having an opening of 48.0 m, 9.3 m clear height under the transversal trusses, using steel grade S235JRG2. After a hard design process remaining deflection of the main resisting structure appeared to produce confusion about the possible reasons for the problem. These problems might have their origin in the erroneous applied assembling techniques combined with deficiencies in executing bolted joints of the elements, unequal supports displacement, the looseness of materials or in the overloading the construction during the covering assemblage. Some of the transversal girder trusses have reached actual remaining displacement approaching the value of the maximum allowed displacement for the corresponding opening after only applying the permanent loads on the structure. In this situation safe and long lifetime exploitation can be guaranteed only by a close behaviour inspection of the construction according to a well prepared building behaviour-following project and by strengthening of the main resistant structure when it is considered necessary and adequate. Thus we came to the conclusion that part of the problems could be eliminated by using convincing safety factors (established by each designer in function of his own experience), apply of adequate erection techniques, in correspondence with the design hypotheses and a much more improved cooperation of the specialists involved in the realization process of challenging structures, according adequate importance to the details.

**Keywords:** *metallic truss, large span, deficiencies, behavior follow-up;*

**Full bibliographic reference:**

### **CASE STUDY: REABILITATION OF WELDING DEFICIENCIES OF A METALLIC CONSTRUCTION**

A. Puskas, A. Bacso

#### **ABSTRACT**

The paper presents the problems encountered at erection of a steel construction with transversal truss girders having opening of 30.8 m made of steel grade S355J2G3. The paper studies the origin of problems, presents issues in detail and rehabilitation of main resistant structure. The origin of the problems consists in a defective manufacturing of steel structure and lack of the quality control. Strengthening and control of rehabilitated welding became complicated and difficult due to unfavourable weather conditions (winter) and due to quality control requirements of welding executed on site [1]. The rehabilitation method used for the butt-welding was chosen strengthening the elements by use of double side plates, designed to the bearing capacity of the connected elements, fixed by use of fillet-welding. Through this procedure the bearing capacity of the junction has been increased significantly. Observing origins of problems and possibilities for rehabilitating the main structure we came to the following conclusion: the presented deficiencies raised due to erroneous fabrication processes of the structural elements. These might have been avoided by completing the structural design with simple solutions and by paying increased attention to the quality certifications and quality verifications of main structural elements.

**Keywords:** *metallic truss, large span, deficiencies, rehabilitation;*

**Full bibliographic reference:**

### **SUSTAINABLE BUILDING SOLUTIONS FOR HOUSING**

V. Ungureanu, M. Mutiu, D. Dubina

#### **ABSTRACT**

Four examples of sustainable mixed building technologies, which combine steel and timber in the framing and different materials for cladding, roofing and flooring, in order to obtain highly performance thermo-energetic properties are presented. Some innovative design solutions have been used in these projects. Three examples present single family houses and one a block of flats, all of them built in Romania. All the buildings are located in medium and high seismic regions. The paper presents aspects related to design and detailing, as well as solutions for cladding and roofing, including structural features, thermo-energetic performance and cost efficiency analysis.

**Keywords:** *sustainable mixed building technologies, high performance thermo-energetic efficiency, steel framed houses, built-in flexibility;*

**Full bibliographic reference:**