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Natural Frequency Changes of Euler-Bernoulli Continuous Beams with Two Spans due to Crack Occurrence

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Abstract: In this paper the authors extend their previous researches on Euler-Bernoulli continuous beams with one span to Euler-Bernoulli continuous beams with two spans. By taking into consideration the four possible supports types, i.e. clamped, hinged, sliding and free, one obtain 16 cases. Herein the case with clamped-hinged ends is taken into consideration, the intermediate support being the hinge. For this case the characteristic equation which permits the calculus of the dimensionless wave numbers is derived. Based on this mathematical relation the dimensionless wave numbers of the first four transversal vibration modes for 100 hinge locations along the beam were derived. It makes possible to find the

healthy beam frequencies for any hinge location. Afterwards, the relationship which permits the calculation of the natural frequencies of the beam in the presence of a crack, anywhere on the beam, is presented. For a given intermediate support location, the changes of natural frequencies due the existence of a crack are derived and compared with the natural frequencies of healthy beam.

Keywords: - Euler-Bernoulli continuous beam, vibration mode, natural frequency, crack

About the Influence of Temperature Changes on the Natural Frequencies of Clamped-Clamped Euler-Bernoulli Beams

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Abstract: In this paper a beam subjected to axial forces induced by temperature changes has been analyzed, in order to highlight the effect of this parameter on the structures natural frequencies. The modal analysis, performed by means of the finite element method (FEM), was conducted on an isotropic double-clamped beam. First the buckling critical loads were derived analytically and the post-buckling domain consequently spited in sub-domains; each of them is characterized by a specific mode shape produced by the static compressive load. Afterwards, the beam was thermally stressed and a step-by step analysis, in which the temperature was gradually changed, was performed. For the modal analysis in case of decreased temperatures a step of five Kelvin degrees was imposed, because just stretching forces are present and he phenomenon is simple to be described. In case of increasing the temperature buckling occurs and the dynamic behavior is more complex. Therefore, a finer step of one Kelvin degree was imposed in the analysis; it helped to find the critical temperatures where the frequencies take the zero value and to correlate these temperatures with the values obtained from the static analysis.

Keywords: - Euler-Bernoulli beam, vibration, modal analysis, frequency, temperature change, buckling

On the Stability of a Class of Non-Ideal Systems

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Abstract: - A vibrating system is said ideal when its excitation is not influenced by the response of the system. When the excitation is influenced by the response of the system, the system is said non-ideal. A new degree of freedom is present in such systems, for which a new equation has to be added in order to describe how the energy source interacts with the vibrating system. The energy transfer is governed by the Sommerfeld effect which appears as a result of the law of energy conservation.
In this paper, the response to vibrations of a class of non-ideal systems is analyzed. The coupling between the structure to a power source acts like a energy sink for which a part of the source energy is spend to deform the system rather than increasing the drive speed. The Sommerfeld effect involves on the one hand the vibration reduction and, on the other hand, a chaotic behavior with riddling bifurcation which explains the creation of the hyperchaotic attractors.

Keywords: - Non-ideal systems, Sommerfeld effect, Stability, Hyperchaotic attractors.

Tubewave - Interactive Software Dedicated to Guided Waves in Tubes

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Abstract: The guided ultrasonic waves have become interesting alternatives to classical pulse-echo nondestructive testing in industrial piping systems. These guided waves have the capability to travel for several meters along pipes, bringing back to the emitting transducer information about possible defects. For this reason, researches were conducted in many laboratories of the world for the last decades.

In our country such preoccupation is relatively recent. Benefiting from a national research project, our team has also developed original software to solve the dispersion curves of tubes. These dispersion curves provide the travel velocity of the guided waves, which are functions of frequency. In most cases, for a given frequency, there are many propagating waves with specific stress-displacements patterns, which are called guides modes. Using these velocities, the experimentalist can adjust the receiver to detect the selected mode, which can be used to detect defects.

The present paper presents the capabilities of the specialized software pack "Tubewave", developed by our team, for homogeneous, isotropic tubes, immersed in air or other light fluids.

Keywords: Guided waves, dispersion curves of tubes

Linear Motion Profile Generation using a Danaher Thomson Actuator with Ball Screw Drive

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Abstract: - A Danaher Thomson linear actuator with ball screw drive is used here to generate vibrations in the 1-3 Hz frequency range. More precisely, the linear motion profile corresponding to the vertical displacements induced under the driver seat by the car ride on some real random road profile was successfully generated using this Danaher Thomson actuator. Also was generated a simplified linear motion profile corresponding to the sum of three sinusoids: a first sinusoidal vibration with $A_1=2$cm amplitude and $f_1=1$ Hz frequency, a second sinusoid with $A_2=1.5$cm amplitude and $f_2=1.5$ Hz frequency and a third sinusoid with $A_3=1$cm amplitude and $f_3=2$ Hz. The actuator is commanded in position ("position mode"), but also in acceleration; for each elementary motion from one position to another, the user provides the limitations in velocity and acceleration/deceleration. The paper presents a simple method to automatically compute the uniform acceleration, maximum velocity and uniform deceleration needed for an elementary motion, taking into account the importance of increasing as much as possible this lifetime expectancy of the ball screw drive.

Keywords: - linear motion, Danaher Thomson electrical actuator, ball screw drive, vertical vibrations, control in position, acceleration/deceleration regime

The Analysis of Factors That Influence the Sound Absorption Coefficient of Porous Materials

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Abstract: - In this paper are presented researches on the identification of factors that influence the sound absorption coefficient of porous materials used for absorption of the sound wave. To achieve these researches were used three materials (glass wool, flexible polyurethane foam and rigid polyurethane foam) for which it was determined the sound absorption coefficient using the impedance tube and was analyzed the influence of thickness, density and structure of these materials on the sound absorption coefficient.

Keywords: - sound absorption coefficient, frequency, thickness, density, open-cell foams.

Vibrations of the Elliptical Gears

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Abstract: In the paper we analyze the elliptical gears from the kinematic, dynamic, and of the inlaid torsional vibrations points of view. We study the uni-lobe and bi-lobe elliptical gears. To be out to determine the mechanical parameters for the dynamical calculation, one obtains, using AutoCAD, the solids that materialize the gears, by an algorithm, similar to the practical procedure to obtain the gears using a basic rack-type cutter. Thus one accurately obtains the masses and moments of inertia of the gears. To obtain the equation of motion, we used a dynamical model of a bar in rotational motion that replaces the mechanism consisting in driving motor, elastic linkage, fly wheel, and the gear of two elliptical gears. The integration of the equation of motion is numerically realized using the fourth order Runge-Kutta method, and a calculation program written in Turbo Pascal. Using certain script files we draw the diagrams of the angular velocity versus time, for the two types of mechanisms, in the variants with and without fly wheel. To study the torsional vibrations inlaid by the gears with elliptical gears, we performed an analysis in frequency (FFT) with the aid of a MatLab calculation program. We present the obtained frequency diagrams. Finally, the conclusions end this.

Keywords: - elliptical gears, torsional vibration, dynamics of mechanism, frequency analysis

Study of the Behavior of a Multi Floors Building in the Case of an Earthquake Using a Piece-wise Model

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Abstract: - This paper realizes a study for the dynamics of a multi floors building excited by a vertical earthquake type excitation. Each floor is considered connected to its neighbors by piece-wise springs and dampers. The numerical study performs an analysis of the dependence on the stiffness, damper and number of floors.

Keywords: - earthquake, buildings model, static equilibrium, piece-wise model.

Experimental studies on Romanian building damping devices SERB C-194 and SERB TEL–150

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Abstract: - This paper presents an experimental study of SERB C-194 and SERB TEL-150 new romanian damping devices used in equipping the buildings for protection during earthquakes. These dampers have a different type of hysteresis curves which is difficult to express with mathematical relations. The hysteresis curves obtained can be used in program software which simulates the building behavior during seisms only if we find mathematical equation which describes the hysteresis. The method used for fitting the experimental curves with a mathematical relation was the Bouc-Wen method. In the final of the paper we present the mathematical relations for both dampers studied. These relations are useful in simulation of these types of dampers during seisms.

Keywords: - Seismic dampers, earthquakes, friction dampers, experimental study.

Computational studies for comparison between Taylor dampers and SERB dampers used in damping systems for a ten stories building

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Abstract: - This paper presents a comparison computational study of the behavior of a ten stories building equipped with SERB C-194 and Taylor dampers during earthquakes, according to romanian codes for seismic analysis. SERB C-194 are new romanian damping devices special created for protection of the buildings subjected to Romanian Vrancea earthquakes. This comparison was made using an program software made by the author which permits time-history analysis of buildings equipped with different damping devices such as: Maxwell, Kelvin-Voigt, Zener, Bouc-Wen, Taylor. The study will compare the drifts and the forces introduced into the structure by the dampers. The romanian dampers are a cheaper way to protect the building during earthquake and restrict the drifts similarly with Taylor devices dampers.

Keywords: - Seismic dampers, earthquakes, friction dampers, computational study, Taylor devices.

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On Nonlinear Computational Assessments of Passive Elastomeric Elements for Vibration Isolation

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Abstract: - The area of this study has framed by the passive isolation of the sensitive embedded systems against shocks and vibration due to various technological equipments. This work deals with computational behavior and nonlinear analysis of passive vibration isolation elements based on neoprene. The author presents a set of results gained by numerical simulation of rheological models behaviour under dynamic loads and the effect of parameters changing against dynamic response. It was used both linear and nonlinear computational models. The base isolation principle has used as main hypothesis in all dynamic simulation cases. The single input single output basic model has used in order to provide a simplest way for estimation of system behaviour correlated with parameters changes. This classical model has also adopted to enable the results deployment for a wide range of vibration isolation applications.

Keywords: - nonlinear dynamics, vibration isolation, computational analysis, rheological model

Computational Assessments on Transversal Vibration of Large Beams due to Impulsive in-Motion Actions

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Abstract: - This study deals with the area of condition monitoring and dynamic damage detection in composites based structural parts embedding insulation systems. The paper contains a briefly presentation of some particular and inadequate aspects performed by computational technique, regarding ordinary behaviour a large reinforced concrete beam subjected to impulsive and mobile loads during the exploitation time. A set of appropriate characteristics of deck bridges has adopted. The computational model in this paper has developed taking into account some particular aspects regarding the structure response of the impact tests applied on deck bridges in view of the dynamic characteristic evaluation and the structural damage level characterization. Advanced computational techniques for signal processing (Power Spectral Density, Short Fourier Transform, and Cepstrum) has used. Concluding remarks dignify the qualitative differences between the simple and the realistic approaches of dynamic perturbations in respect with the truck – obstacle – beam interactions.

Keywords: - condition monitoring, structural integrity, nonlinear dynamics, vibration, damage detection

Considerations on operating principle of fluid viscous dissipation model used for bridge seismic isolation

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Abstract: - The main concern of structural engineers is related to capabilities to ensure structure stability during seismic actions. Therefore different mechanical systems have been designed which can be attached to structures in order to change their behavior during earthquakes. This paper presents a special device that can be mounted at bridge or viaduct structures aiming to obtain an improved behavior of theese structures during earthquake actions. The special device is presented as a hydraulic system that can assure dissipation of earthquake input energy. Along with the sliding and elastomeric bearings, the fluid viscous device may form a complete safety system capable to protect the isolated structure from the earthquake destructive actions. The fluid viscous system is composed of a cylinder with piston which can be translated inside the cylinder through the hydraulic fluid due to the orifices formed in the piston head. The fluid used for these special devices is typically mineral or silicone oil. Usually viscous fluid devices are connecting the bridge foundation and superstructure, so that in the occurrence of an earthquake, the piston is forced to move through the fluid medium inside the cylinder. Due to the low value of the passage orifices diameter the displacement is strongly restrained. Because of this resistance achieved at the hydraulic device ends a considerable amount of energy from the total earthquake energy is taken over, dissipated and converted into caloric energy due to internal friction forces, being after transferred to the external environment through the cylinder walls. In this paper it is presented a model of viscous fluid dissipation device that can be used in isolation of bridge or viaduct structural types against seismic activities. A three-dimensional assembly model was conducted at a reduced scale for the device equipped with flanges for clamping to the structural elements which has been analyzed in terms of operation principle using ANSYS FLOWIZARD program.

Keywords: - energy dissipation, fluid viscous damper, hydraulic actuation

On Modelling of Bucket Oscillations for a Wheel Loader

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Abstract: - In this paper bucket oscillations of the wheel loader was studied for two working cases: to slow lowering motion of the boom with full bucket and, respectively, to travelling on the uneven road. Estimation of the overloads induced into the boom and bucket structure it was quantified by a dynamic coefficient. A nonlinear model with 3DOF it was established for numerical simulation of the differential equations of loader motion (into both study cases) and for dynamic coefficient evaluation. The proposed method permits study of the system response to parameters variation (e.g. different spring damper setup, various load and travel conditions) and comparison between the bucket stability of different constructive types of classical wheel loaders.

Keywords: - loader, bucket, boom, wheel, dynamics.

On Nonlinear Dynamics of Dragline Bucket Subjected to Flexible Linkages

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Abstract: - In this paper, the oscillatory motion of the dragline loaded bucket it was highlighted. Hence, the authors proposed a new computational model useful for study of the nonlinear dynamics of the bucket. The linkage of the bucket, consist on hoist rope, it was modelled as flexible element. Hereby, the hoist rope – bucket system provides the pendulum movement of the bucket on horizontal direction, and linear oscillations such as single degree of freedom vibratory system on vertical direction. The numerical simulations, implemented in MAPLE software, show that the trajectory of the mass centre of the bucket is directly influenced by the each structural element motion which compose the proposed model.

Keywords: - dragline, bucket, flexible linkage, oscillation, dynamics.

Effect of Impact Mass on Tool Vibration and Cutting Performance During Turning of Hardened AISI4340 Steel

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Abstract: - A major apprehension in manufacturing industry is the tool vibration, which has considerable influence on productivity and production costs. The present investigation aims at developing impact mass for suppressing tool vibration and promoting better cutting performance during turning of hardened AISI4340 steel using hard metal insert with sculptured rake face. An impact mass used in this study consists of a concentrated mass made of brass of predetermined size and shape mounted on the shank of tool at a specific location. Impact mass was designed and the location of the damper on the tool shank for achieving effective damping was determined using computational analysis. When the damping mass was mounted on the tool shank, its vibration characteristics got altered and provided an inherent damping capability to the tool holder for suppressing tool vibration. Cutting experiments were conducted to study the influence of Impact mass on tool vibration and cutting performance during hard turning. From the results it was observed that the use of impact mass on tool shank reduces tool vibration and improves the cutting performance effectively.

Keywords: - tool vibration, Impact mass, hard turning, Damping ratio, Surface roughness, tool wear, cutting force.

Dynamic Response Analysis of the Road System Compaction According to the Forced Vibration Mode

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Abstract: - Mechanical systems are composed of elements of movement, elastic rigid bodies and joints. If referring to moving elements they are materialized by bodies of different geometrical configuration and are connected to each other by joints. The joint role is to fulfil the possibility of movement of the elements or the possibility of imposing restrictions or constraints of the relative movements of the components of the mechanical system. The structural analysis of a mechanical system is aimed at to identify the size and the arrangement of the elements of the system relative to its required function. Kinematic analysis includes the study of motion of each component of the considered mechanical system being required to know the values at any point of time and vectors guidelines position, velocity, acceleration, without regard to the causes that are producing the movement.

Keywords: - vibratory compactor, vibration parameters

Rheological Models of the Materials for the Road System in the Compaction Process

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Abstract: - This paper presents a simplified theory of compaction based on idealized rheological models that allow to make preliminary determinations of characteristic parameters which in turn are used to determine other parameters[1].

For the compaction study is considered that the land is semi-infinite, homogeneous and isotropic, and the limit of elasticity is infinitely large [2;3]. Initially must be considered the fundamental mechanical properties of the land: elasticity, viscosity, plasticity.

Keywords: - rheological models, composed models

Dynamic analysis of viaducts' behavior on dynamic action

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Abstract: - The dynamic modeling, aims to analyze the dynamic behaviour of the viaduct to external actions from the road traffic and / or seismic movements. The rigid model with six degrees of freedom with viscoelastic links triortogonale with elastomeric bearings is based on the dynamic analysis adopted in this research.

Keywords: - viaduct model, dynamic modeling, coupled vibration

Dynamic Isolation in Case of an Elastic Supported Viaduct

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Abstract: - The dynamic modeling, aims to analyze the dynamic behaviour of the viaduct to external actions from the road traffic and / or seismic movements. The analytical expressions of pulsation, frequency and of the eigenvectors are presented, thus putting in evidence the influence of inertial and structural characteristics on these.

Keywords: - viaduct model, transmissibility of vibrations.