

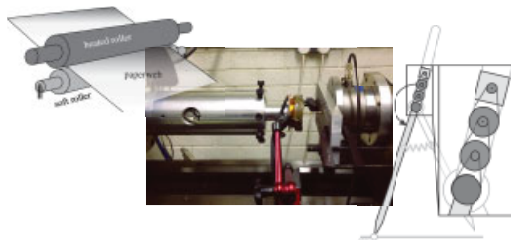
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Special Issue

“ICoVIS 2013: Vibro-Impact Systems and Systems with Non-Smooth Interactions”,

Guest Editors: Alexander Fidlin, Karlsruhe and Vladimir I. Babitsky, Loughborough, UK



COVER PICTURE

For more information to these pictures see pages 905, 923, and 970 of this issue.

EDITORIAL

Page **897** ————— Alexander Fidlin and Vladimir I. Babitsky

Editorial:

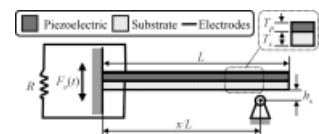
A selection of the lectures from the 3rd International Conference on Vibro-Impact Systems and Systems With Non-Smooth Interactions, 23–27 July 2013 Leinsweiler near Karlsruhe, Germany

EDITOR'S CHOICE

Page **898–903** ————— Ieva Milasauskaite, Rolanas Dauksevicius, Vytautas Ostasevicius, Rimvydas Gaidys, and Giedrius Janusas

Influence of contact point location on dynamical and electrical responses of impact-type vibration energy harvester based on piezoelectric transduction

This research work considers a more efficient vibro-impacting piezoelectric energy harvester (VIPEH) structure, which is intended both to prevent the device from excessive displacements as well as to increase its operational bandwidth in actual excitation conditions. Multi-physics finite element model of the VIPEH was developed in Comsol with the objective to analyze influence of stopper location on the mechanical and electrical characteristics of the piezoelectric transducer, followed by the experimental study of two device configurations. Numerical and experimental results revealed that stopper location influences the magnitude of generated voltage since, at certain stopper location points, higher vibration modes are excited during the impact.



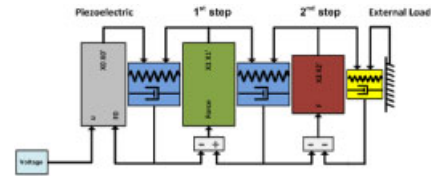
ORIGINAL PAPERS

Page **904–910**

Xuan Li, Vladimir Babitsky, Robert Parkin, and Alan Meadows

Autoresonant excitation and control of nonlinear mode for ultrasonically assisted drilling

The application of high-frequency vibration processes for intensification of machining requires a control technique for identification, excitation and stabilisation of the nonlinear resonant mode in machining systems with unpredictable variation of processing loads. Such a technique was developed with the use of a self-exciting mechatronic system. This method of control is known as autoresonance. Autoresonant control of ultrasonically assisted drilling machine intended to improve machining process is thoroughly analysed and the simulation results of analysis for both mechanical feedback and electrical feedback are presented together with the application of different filters.

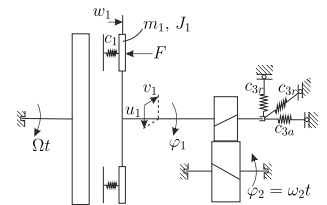


Page **911–916**

Georg Jehle and Alexander Fidlin

Friction induced vibrations in shift gearboxes

In shift gearboxes, audible vibrations can arise during the process of clutch engagement. Measurements show an unstable axial motion of the gear unit input shaft. In order to explain this effect, an approach which establishes the interaction of the slipping clutch and the gearing is proposed. The suggested model consists of a pressure plate, a clutch disc, a gear unit input shaft and a tooth contact. The gear unit input shaft is rigidly connected to the gearing and the clutch disc and has translational and rotational degrees of freedom. The tooth contact imposes a kinematic constraint on the system. This is why the sliding friction torque is transformed into forces in axial and radial direction of the shaft.

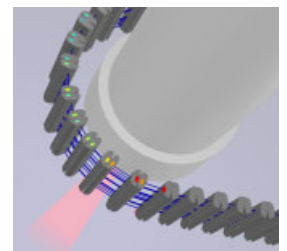


Page **917–922**

Nikolay Shabrov, Yuri Ispolov, and Stepan Orlov

Simulations of continuously variable transmission dynamics

An overview of one specific design of continuously variable transmission (CVT) is presented. An approach to the modeling of contact interactions is described. Several CVT models of different complexity are developed and used in numerical simulations. The results of simulations can be used to estimate local behavior of CVT parts, as well as its global characteristics.

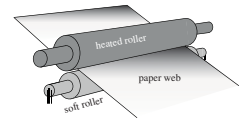


Page 923–932

Manuel Eckstein and Peter Hagedorn

On the effect of paper plasticity in calenders

The manufacturing process of paper machines consists of several steps to produce high quality papers. This is done by sequentially lined-up machines including the head box, the drying sections, the finishing part and the wrapping systems. In the finishing part, the rollers of the paper calender compress the fibrous material involving viscoelastic and plastic deformations. Modern calenders are composed of several roller pairs, each consisting of a soft and a hard roller. The homogenization of the paper density and the refinement of the paper surface is achieved by the compression in the roller pairs.

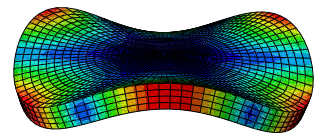


Page 933–944

Andreas Hanselowski and Michael Hanss

Analysis of epistemic uncertainty for the friction-induced vibration

The phenomenon of brake squeal, which is a type of friction-induced vibration, is analyzed using a pin-on-disc system. For this purpose, a finite element model is derived and its parameters are updated on the basis of experiments. The FEM analysis includes the complex eigenvalue analysis and the transient analysis. As the brake-squeal phenomenon is very sensitive with respect to parametric uncertainty, the two numerical analyses are combined with an uncertainty analysis, which in this study is based on fuzzy arithmetic. The uncertainty analysis enables the determination of both the overall uncertainty of the considered output quantity and the influence of each individual uncertain model parameter on the overall uncertainty of the output. With this information about propagation and influence of parametric uncertainty in the system, the methods of complex eigenvalue analysis and transient analysis can be compared with respect to their appropriateness for predicting the tendency of the brake to squeal.

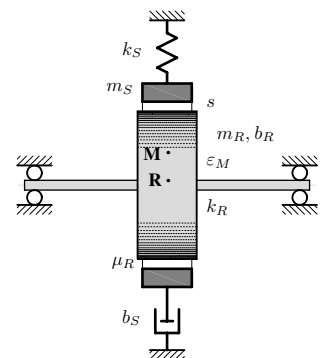


Page 945–950

Oliver Alber and Marcel Mahner

Description of sub- and superharmonic motion in rotor-stator contact using Fourier series

This paper deals with the description of steady-state sub- and superharmonic motion in rotor-stator contact using truncated complex Fourier series. Two different approaches are presented with different stages of simplification. In particular, a kinematic contact condition describing continuous contact is used. The multi-harmonic balance method is applied to solve the differential algebraic system of equations. A further simplification is implemented which uses the triangular inequality to approximate the nonlinear term in the kinematic contact condition. The Fourier coefficients of the nonlinear term are calculated using an integral expression. Reasonable initial values of the Fourier coefficients for the numerical solution are obtained by a hybrid approach. Results show good agreement with calculations by direct numerical integration using a pseudo-linear viscoelastic contact model.

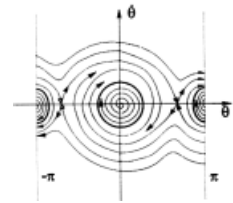


Page **951–956**

D. Yu. Skubov and D. S. Vavilov

Dynamics of the conductivity bodies of pendulum types in alternating magnetic field

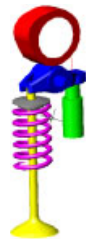
The investigations fulfilled in this article are founded on two results. The first is experiments of M. Beteno, Y. Duboshinsky. The description of these experiments is adduced in [1]. In these experiments the low frequency oscillations of iron ball suspended on the thin string [1] were obtained (frequency of these oscillations is order to eigen frequency of pendulum). [1] P. S. Landa, *Nonlinear Oscillations and Waves* (Nauka, Moscow, 1997), p. 495.

Page **957–967**

Josef Haslinger, Guenter Offner, and Martin Sopouch

Non-smooth dynamics of coil contact in valve springs

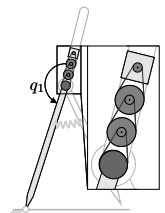
This contribution describes the dynamic simulation of the contact of coils of a valve spring within a multi-body system application. The spring is described by a multi-mass model. Contacting spring coils influence the dynamical properties of a valve spring significantly. The possible interaction between adjacent coils is modeled by means of non-smooth mechanics. Signorini conditions on displacement level are imposed on contact candidates. The set of inequality constraints is transformed into a set of equations by introducing a nonlinear complementarity function, which contains the semi-smooth maximum function.

Page **968–973**

Fabian Bauer, Alexander Fidlin, and Wolfgang Seemann

Energy efficient bipedal robots walking in resonance

This contribution presents a method to improve the energy efficiency of walking bipedal robots over 50% in a range of speed from 0.3 to 2.3 m/s by the use of constant elastic couplings. The method consists of modeling the robot as underactuated system – so that it is making use of its natural dynamics instead of fighting against it – controlling its joint-angle trajectories with input-output feedback linearization and optimizing the joint-angle trajectories as well as the elastic couplings numerically.

**BOOK REVIEWS**Page **932**

F. Irgens: *Rheology and Non-Newtonian Fluids*.
Springer Verlag Cham, Heidelberg et al. 2014
Reviewer: Bernd Platzer, Chemnitz

Page **974**

B. S. Jovanović, E. Süli: *Analysis of finite difference schemes for linear partial differential equations with generalized solutions*
Springer Verlag London 2014
Reviewer: H.-G. Roos, Dresden

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