Program

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24 SEMINAIRE FRANCO POLONAIS de MECANIQUE

24 Polsko Francuskie
Seminarium Mechaniki
oraz
9 Konferencja
„Tarcie" -2016
24-eme
Séminaire Franco-
Polonais
en Mécanique

et
9-eme Int. Conference
„Frottement 2016"

Universite de Perpignan

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Université de Perpignan Via Domitia

Département Mécanique Appliquée de

LAMPS

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XXIV FRANCUSKO-POLSKIE SEMINARIUM MECHANIKI

17-18.X.2016 r. Warszawa

Komitet organizacyjny:
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Dr hab. inż. Robert Zalewski
mgr Paweł Chodkiewicz
mgr Małgorzata Kowalska

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Przewodniczący / Coordonnateurs : **J. Bajkowski (Warszawa/Varsovie)**
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J.M. Bajkowski (Varsovie)
M.Bajkowski (Varsovie)
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R. Zalewski (Varsovie)
B. Zegmati (Perpignan)
D. Zied (Sfax)

Programe:
Poniedziałek / Lundi / Monday (17.10.2016)

OTWARCIE / OUVERTURE / OPENING
Sala / salle / hall: „Zbigniewa Osińskiego”

9:30 - 10:45 Rejestracja uczestników / Enregistrement / Registration
10:55 – 11:15 Otwarcie / Ouverture / Opening

WYSTĄPIENIA:

Dziekan / Doyen / Dean,

Rektor PW, Recteur d’Universite,

Dyrektor Instytutu / Directeur de l’Inst. / Directeur of Inst.,

Attache Ambasady Francuskiej / Mot d’Attache d’Ambassade Francais / Speach of the Attache of French Embassy, Dyrektor Instytutu Francuskiego / Directeut de l’Institut Francaise de Varsovie

SESJA I / SESSION I / SESSION I
Sala / sale / hall: „Zbigniewa Osińskiego”

Przewodniczący / Chairman
PROF. DR HAB. INŻ. STANISLAW RADKOWSKI
PROF. DR HAB. INŻ. BELKACEM ZEGHMATI

Variational and Numerical Analysis of Two Contact Problems
MIRCEA SOFONEA , MIKAEL BARBOTEU
University of Perpignan Via Domitia

Spiral Bevel Gears Milled on the 5-Axis CNC Machine
PIOTR SKAWIŃSKI, PRZEMYSŁAW SIEMIŃSKI
Warsaw University of Technology

Adaptive Technics for Stochastic Simulations for Linear Problems
ERIC FLORENTIN
INSA Centre Val de Loire Bourges-Blois

Critical Spin Rate of Rotating Nanobeams by Liapunov's Direct Method
ANDRZEJ TYLIKOWSKI
Warsaw University of Technology

SESJA II PLAKATOWA / SESSION II-POSTERS / SESION II-POSTERS
Sala/salle/hall: III piętro / III etage / III floor

Przewodniczący / Chairman
PROF. DR HAB. INŻ. CZESŁAW BAJER
PROF. DR HAB. INŻ. STÉPHANE ABIDE

12:30 – 15:00 Prezentacja plakatów
15:15- Obiad / diner / lunch

Programe:
Wtorek / Mardi / Tuesday (18.10.2016)

OTWARCIE / OUVERTURE / OPENING
Sala / salle / hall: „Zbigniewa Osińskiego"

9:30 - 10:30 Rejestracja uczestników /Enregistrement /Registration

SESJA III / SESSION III / SESSION III
Sala /sale /hall: „Zbigniewa Osińskiego"

Przewodniczący / Chairman
PROF. DR HAB. INŻ. PHILIPPE NARDIN
PROF. DR HAB. INŻ. ERIC FLORENTIN

A Parallel Strategy for a Fourth-Order Accurate Finite Difference Navier-Stokes Solver
STÉPHANE ABIDE, BELKACEM ZEGHMATI
University of Perpignan Via Domitia

Semi-Active Control of Vibrating Structures
CZESŁAW BAJER
Institute of Fundamental Technological Research, Polish Academy of Sciences

Hanging Roof of Opera Leśna in Sopot as an Example of Composite Technical Fabrics Development

PAWEŁ KŁOSOWSKI
Gdańsk University of Technology

XXXXXXX

PHILIPPE NARDIN
Universite de Franche Comte Besancon

SESJA IV PLAKATOWA / SESSION IV-POSTERS / SESION IV-POSTERS
Sala / salle / hall: III piętro / III etage / III floor

Przewodniczący / Chairman
PROF. DR HAB. INŻ MIKAEL BARBOTEU
PROF. DR HAB. INŻ. JERZY BAJKOWSKI

12:00 – 15:00 Prezentacja plakatów
15:00 Obiad /diner /lunch

A Parallel Strategy for a Fourth-Order Accurate Finite Difference Navier-Stokes Solver

STÉPHANE ABIDE, BELKACEM ZEGHMATI
stephane.abide@univ-perp.fr, zeghmati @univ-perp.fr

University of Perpignan Via Domitia, 52 Avenue Paul Alduy, 66860 Perpignan, France

We present a parallel high-order finite difference solver for Direct and Large Eddy Simulation (DNS/LES) of incompressible flows. The core of this solver is based on a fourth-order compact scheme discretization based on a staggered grid. The Runge-Kutta/Crank-Nicolson third-order low-storage scheme combined with a projection scheme are retained. The proposed parallel strategy conserves the high-accuracy and the conservation properties. It involves two kinds of parallelism to deal efficiently with, the evaluation of the compact derivatives/interpolations, and the solutions of the dense linear systems associated to the momentum and the pressure equations. This two points are detailed in this work, and the influence of the approximation introduced by the parallelization is assessed by investigating several numerical turbulent benchmark. Moreover, the interesting scalability of the present method is demonstrated up to 4096 cores.

Experimental Research on Impact of Deviation Angle Between Magnetorheological Damper Axis and Runners Axis in Butt on Its Functionality While Taking a Shot

MARCIN BAJKOWSKI, MAREK RADOMSKI, ROMAN GRYGORUK
granada@pompy.pl, mr@wip.pw.edu.pl, r.grygoruk@wip.pw.edu.pl

Warsaw University of Technology, Department of Construction Engineering and Biomedical Engineering

The paper presents the results of experimental research on the impact of magnetorheological damper (MR) fitted to the butt on the gun and the shooter while taking a shot. The investigation focused on the determining the impact of deviation angle between MR damper axis and runners axis in butt on the recoil process, and in particular on the impact of the butt on shooter's shoulder while taking a shot. Example results of tests regarding the shotgun with a caliber of 12/70 are provided. Research results led to general conclusion, that the value of this angle has no significant effect on the recoil process and the dissipation of recoil energy. Therefore, the implementation of constructional solutions enabling adjusting the deviation angle between MR damper axis and runners axis in butt is not justified in the practice of gun design.

Multi-Axial Impact Energy Absorber

PIOTR BARTKOWSKI, ROBERT ZALEWSKI
bartkowski_piotr@onet.pl, robertzalewski@wp.pl

Warsaw University of Technology

In this paper the concept of multi-axial impact energy absorber made of Vacuum Packed Particles (VPP) is described. The absorber consists of two aluminum plates connected to the tube pivotally attached to one of them. The space between the plates is filled with a granular material. The joint enables the transfer of shear forces between the plates, and the moments are transmitted through the granular material. With the ability to change the interaction forces between the granules, by changing the vacuum, it is possible to adjust the flexural stiffness of the absorber, controlling the response of system to impact forces. An important feature of the absorber is the possibility of multiple use. After impact the granulate deforms in a pseudo-plastic way. After the partial vacuum elimination, the forces between the granular material is relatively low, so that the applied springs having a relatively low stiffness enable the damper to return to the initial equilibrium state.

Modeling of Porous Cancellous Bone-Implant Fixation Based on the Biot's Theory

BERDYCHOWSKI M.[1], MIELNICZUK J.[2],

[1]Poznan University of Technology, Chair of Basics of Machine Design
[2]Rail Vehicles Institute "TABOR"

The hip joint is one of the most exposed to overload-degenerative changes elements of the osteoarticular human system. If injured, the hip joint can be replaced with implant. In this paper a theoretical analysis of porous bone-implant coupling is performed. The new type of endoprothesis with needle – palisade fixation system is used. The cancellous bone is described as a hollow circular cylinder formed of isotropic poroelastic material filled with viscous intraosseous fluid. The conical metallic implant, axially compressed, is assumed to be undeformable in comparison to cancellous bone. The Biot's formulation of theory of poroelasticity is used and by means of the modified Huber-Mises yield criterion the new yield condition (constitutive equation) has been determined as a function of strain. From this criterion it is possible the maximum permissible displacement of implant seating in bone to determine.

Transverse and Longitudinal Damped Vibrations of T-Type Frame

MARTA BOLD, WOJCIECH SOCHACKI
bold@imipkm.pcz.pl, sochacki@imipkm.pcz.pl

Czestochowa University of Technology, Institute of Mechanics and Machine Design Foundations

In work, the influence of different kinds of damping on transverse and longitudinal vibrations of T type frame was formulated and solved. Damping in adopted model is a result, of taken into account internal damping of viscoelastic material of beams that model the system, external viscous damping and constructional damping. Constructional damping occurs as a result of movement resistance in the supports and it was modelled by the system of rotational viscous damper and rotational spring with linear characteristic. The boundary problem connected to the free vibrations of the considered non-conservative (due to damping) system was formulated on the basis of Hamilton's principle. The results of numerical research taking into consideration influence of changes in geometry of the system and the variable values of damping coefficient and spring rigidity coefficient were presented in 2D figures and spatial presentations.

Zastosowanie Metody PSO do Optymalizacji Trajektorii Manipulatora Typu SCARA

DAWID CEKUS, DORIAN SKROBEK
cekus@imipkm.pcz.pl, skrobek@imipkm.pcz.pl

Politechnika Częstochowska, Instytut Mechaniki i Podstaw Konstrukcji Maszyn

W niniejszej pracy zastosowano jeden z algorytmów heurystycznych - metodę Particle Swarm Optimization (PSO) - do wyznaczenia optymalnej trajektorii końcówki roboczej manipulatora typu SCARA. Zadanie polegało na określeniu najkrótszej drogi łączącej dwa zdefiniowane punkty z ominięciem przeszkód. Założono także, że wysokość przeszkód uniemożliwia przenoszenie elementów ponad nimi, co sprowadziło zagadnienie do problemu dwu-wymiarowego.

W obliczeniach analizowano wpływ: wielkości populacji, wartości współczynnika uczenia, wartości współczynnika wagowego, liczbę iteracji oraz liczbę punktów definiujących trajektorię na działanie algorytmu i uzyskiwane odpowiedzi.

Na podstawie przeprowadzonych analiz wyznaczono najkrótszą trajektorię oraz na podstawie kinematyki odwrotnej wyznaczono położenie ramion, a wykorzystując metodę różnic wstecznych wyznaczono dla każdego ramienia prędkości i przyspieszenia kątowe.

Use of the PSO Method for Optimization the Trajectory of SCARA Manipulator

DAWID CEKUS, DORIAN SKROBEK
cekus@imipkm.pcz.pl, skrobek@imipkm.pcz.pl

Politechnika Częstochowska, Instytut Mechaniki i Podstaw Konstrukcji Maszyn

The work presents the use of one of the heuristic algorithms - the Particle Swarm Optimization method - to determine the optimal trajectory of a SCARA manipulator end-effector. The task was to calculate the shortest path connecting two defined points avoiding obstacles. It is assumed that the height of the obstacles preventing the transfer of elements above them, which comes down the issue to the two-dimensional problem. The influence of the number of points creating the trajectory, the number of iterations, the impact of cognitive and social parameters as well as the inertia weight on the algorithm action and the resulting response has been analyzed. The shortest trajectory, the position of the arms (using the inverse kinematics), the angular velocity and angular acceleration (using the backward difference method) for each arm have been determined.

A Simplified DEM Model of Foil to Provide a Special Pressure Boundary Conditions

PAWEŁ CHODKIEWICZ[1], JAKUB LENGIEWICZ[2], ROBERT ZALEWSKI[1]
pawel@chodkiewicz.com.pl, jleng@ippt.pan.pl, robertzalewski@wp.pl

[1]Warsaw University of Technology
[2]IPPT PAN

Nowadays the increased interests is observed in innovative materials that are able to change their mechanical properties. Vacuum Packed Particles (VPP) seem to be a new idea in the area of advanced structures. In certain technical applications they can compete with popular smart structures like magnetorheological (MR) or electrorheological (ER) fluids. A VPP device is built of loose granular material encapsulated in a hermetic elastic envelope (foil). We can change its properties simply by inducing underpressure using a vacuum pump. In this work, authors present a new discrete element model of foil to provide special pressure boundary conditions in analyses of VPP devices. The model takes into account deformation of the foil and consequent changes in the local pressure direction. Also frictional contact between foil and particles is fully accounted for. The model was implemented as an extension of Yade DEM open-source discrete element method environment. Preliminary results of VPP damper analysis are presented. Qualitative agreement with previous experimental results has been observed.

Studies on Photoelastic Models of Elementary Crushing Processess

PAWEŁ CIĘŻKOWSKI, PIOTR PRZERWA, SEBASTIAN BĄK
pawel.ciezkowski@simr.pw.edu.pl, sebastian.bak@simr.pw.edu.pl

Warsaw University of Technology

This paper analyzes the process of compressing of a Plexiglas block between flat, coaxially arranged three stamps. We have also studied the compression process of cylindrical sample between flat crushing plates and specimens parallelly milled from two sides. Discussed issues represent compression of blocks in the working space of some crushers and therefore the results of relevant studies can be used to solve technical problems. The measurements were carried out using a hydraulic press and polariscope. Isochromatics characteristic images for various elementary processes of crushing were determined. Then analyzed crushing processes were modeled using Finite Element Method (FEM). Results of laboratory tests were compared to the results of computer simulations. As a result of simulations and photoelastic tests, the stress distributions were obtained. Preliminary studies performed on the blocks of plexiglas showed good compatibility of photoelastic results with those determined using FEM.

Selection of Crucial Geometrical Features During Cylindrical Connections Modelling

MARIAN DUDZIAK, ANDRZEJ KOŁODZIEJ, KRZYSZTOF TALAŚKA

The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz

The assemblies of machine parts with deviations such as radial deviations, deviations of a cross section and their compilations have variable values of local stresses and displacements. The type of form deviations and their values play a key role in design process and then in machine operation. A test stand with an extensometer for measuring the axial friction force and moment of friction is presented. The experimental investigations have been conducted in order to determine the influence of form deviations on the values of axial friction force (during displacement of shaft) and moment of friction (during rotation of shaft). The issue of contact problems has been presented for numerical simulation of contact between a three-angular shaft with a saddleback distortion (with variable value of cross section deviation) and a rigid hole - the shaft was placed in different angular positions. The occurrence of variable relative and contact stresses and resistance of axial movement and rotation of the shaft has been showed.

Redukcja Drgań za Pomocą Struktur Warstwowych z Inteligentnym Rdzeniem

B. DYNIEWICZ[1], J. M. BAJKOWSKI[2], C. I. BAJER[1]

[1]Instytut Podstawowych Problemów Techniki PAN
[2]Politechnika Warszawska

Rosnące wymagania stawiane przed nowoczesnymi konstrukcjami w zakresie poprawy bezpieczeństwa, komfortu oraz trwałości układów mechanicznych powodują konieczność poszukiwania nowych rozwiązań, które w istotnym stopniu zmniejszą szkodliwe drgania, zapewniając jednocześnie odpowiednią trwałość i wytrzymałość proponowanego rozwiązania. W konsekwencji, od dłuższego czasu adaptacyjne struktury stały się tematem intensywnych badań. Prawidłowo zaprojektowane umożliwiają znaczną poprawę właściwości dynamicznych konstrukcji, w porównaniu do ich odpowiedników pasywnych, dzięki elementom wykonawczym, którymi są materiały inteligentne. Podjęte badania dotyczyły struktur warstwowych z materiałem rdzenia o modyfikowanych własnościach mechanicznych. Istotą problemu jest synergia struktury warstwowej oraz półaktywnie sterowanego materiału inteligentnego stanowiącego jej rdzeń. Jak dotąd temat ten w literaturze praktycznie nie był podejmowany, prawdopodobnie z powodu multidyscyplinarności problemu i konieczności zastosowania teorii z pogranicza sterowania optymalnego oraz dynamiki konstrukcji. W pierwszym przypadku rdzeń stanowił magnetoreologiczny elastomer, który pod wpływem zmiany pola magnetycznego zmienia swoje parametry reologiczne. W drugim przypadku mamy do czynienia z materiałem granulowanym sterowanym podciśnieniem. Opracowano odpowiednie modele fizyczne i matematyczne obu rozwiązań. Dysponując modelem dynamiki poszczególnego układu oraz funkcjonałem jakości sterowania sformułowano i rozwiązano zadania sterowania optymalnego. Rozwiązanie numeryczne problemu minimalizacji w obu przypadkach wykazało periodyczny, bistabilny charakter funkcji sterującej. Skuteczność sterowania sięgająca 50% w stosunku do rozwiązania pasywnego została pozytywnie zweryfikowana eksperymentalnie na stanowisku badawczym. Zaobserwowano, że w wyniku modyfikacji parametrów fizycznych rdzenia, konstrukcja zaczyna drgać z wyższymi modami i dzięki tłumieniu materiałowemu poszczególnych warstw elementów konstrukcyjnych, drgania całego układu są szybciej tłumione. Badania potwierdziły, że inteligentne struktury warstwowe powinny z powodzeniem znaleźć zastosowanie w wielu dziedzinach przemysłu, głównie branży lotniczej, kolejowej oraz motoryzacji.

Vibration Abatement Using Layered Structures With Smart Core

B. DYNIEWICZ[1], J. M. BAJKOWSKI[2], C. I. BAJER[1]

[1]Instytut Podstawowych Problemów Techniki PAN
[2]Politechnika Warszawska

The increasing comfort, safety and durability demands for modern mechanical constructions motivate to search for new robust solutions and durable devices providing efficient reduction of harmful vibrations. Consequently, adaptive structures have become the subject of an intense research effort. Properly designed adaptive systems incorporating smart material actuators, allow significant improvement of dynamic properties, compared to their passive damping equivalents. The presented study concerns layered structures with a core with modified mechanical properties. The main issue is combining features of layered system and semi-actively controlled smart core material. So far this subject was not extensively examined in literature, probably due to the multidisciplinary character related to optimal control theory and dynamics of construction. In the first considered case the smart core was made of magnetorheological elastomer, which changes its rheological parameters under the influence of the magnetic field. In the second case, an elastic, pneumatically controlled pouch filled with bulk granular material was used as a core. Appropriate mathematical and physical models for both cases were developed. The formulated models of dynamics of each system and the functional of the control quality were used to solve the optimal control problem. The numerical solution of the minimization problem showed periodical, bistable nature of the control, for both cases considered. The effectiveness of the control reaching up to 50% improvement compared to the passive solutions has been verified experimentally. It has been observed, that modifying the physical parameters of the core excites higher vibration modes of the system and due to the material damping of the layers, the vibrations of the systems are damped faster. Studies have confirmed that smart layered structures could be successfully used in many applications especially aerospace, railway and automotive transport.

Adaptive Technics for Stochastic Simulations for Linear Problems

ERIC FLORENTIN
eric.florentin@insa-cvl.fr

INSA Centre Val de Loire

Increase of computational power allows to simulate more and more complex mechanical problems. For example, taking into account different variability of data of the problem is a key issue both in industry and academic laboratories. Indeed, for these stochastic simulations, obtaining relevant results is still a challenge.

Stochastic simulations mainly rely on finite element approximation can be classified in two parts : intrusive techniques and non-intrusive techniques. The first ones correspond to a generalization of the finite element method and are very expensive and need a specific implementation. The second ones are easier to implement but introduce more approximations.

The presented method is a non-intrusive. The approximation introduced is controlled using an adaptive technique. The idea is to define a local quantity of interest and introduce a second problem linked to this quantity. Then solving this second problem makes it possible to define an estimate of the error committed during the non-intrusive solving.

Stress Intensity Factors Calculations for Fatigue Growth Analyzes of Cracks in Hollow Cylinders Under Tension or Bending

PAWEŁ GRABOWSKI, ARTUR JANKOWIAK

Warsaw University of Technology,Institute of Construction Machinery Engineering

The paper describes possible application of two-dimensional weight function to calculate stress intensity factors (SIF) on front of the crack situated in cross-section of hollow cylinders. Because fatigue resource depends strictly from SIF values, the results obtained with the method might be used as an input data for fatigue life assessments. Analyzed cases are very important from technical point of view, as they correspond to cross-sections of many machines' parts (e.g. hydraulic cylinders, pipelines, etc.). Verification of SIFs results had been performed for a few cases that might occur in real conditions of operating, by comparison to values obtained with commonly used, simplified analytical methods. Moreover, possibilities of method's application for calculating SIF values for further crack growth analyses, had been chcecked for some other specific cracks of various types and shapes, that might be observed in considered types of elements.

Using of entropy measures in diagnostics of gears

ROBERT GUMIŃSKI, STANISŁAW RADKOWSKI

Warsaw University of Technology, Institute of Vehicles

Occurring of failure is accompanied by changing of energy distribution of vibroacoustic signal generated by a dynamic system. Hence, comparing the energy distributions of signals observed for technical conditions without failure and for failure states of dynamic model one has access to information about the formation and development of damaging process. Because the actual measured signal will contain both the part generated by a diagnosed kinematic pair as components transmitted through the structure to the measuring point, other an additional problem to be solved is the problem of the separation of diagnostically useful signal part. The presented approach is proposed to detect and analyze diagnostic information about the stages of development of failure taking into account the impact of nonlinear effects and nonstationary phenomena based on the analysis of entropy changes of the vibroacoustic signal.

Using of Bispectral Entropy Method in Failure Diagnostics of Gears

MARCIN JASIŃSKI

Warsaw University of Technology, Institute of Vehicles

The paper discusses the problem of proper selection of entropy method, for detecting and the identification of the failures. According to the theory of Shannon, entropy is a measure of the uncertainty, while the amount of mutual information contained in the random η of the random process. Particular attention was paid to the possibility of using bispectral entropy change for example signals generated during the formation and propagation of break the gear tooth. Referring to the energy distribution of signal on bispectral plane the bispectral entropy was determined of the classical Shannon's way.

Motion Modeling of the Four-Wheeled Mobile Platform Under Slippage Conditions

A. JASKOT, B. POSIADAŁA, S. ŚPIEWAK
bogdan.p@imipkm.pcz.pl

Częstochowa University of Technology

The work is dedicated to the motion modeling of the four wheeled mobile platform under the slippage conditions. Friction forces, in longitudinal and in the transverse directions, are considered in the presented dynamics model of the platform. The relation between friction and active forces (which cause the motion) are also included. The formulated initial problem has been solved by using the Runge-Kutta method of the fourth order. The prototype of the platform with four independently steered wheels has been designed to enable its motion examination considering different configurations of the wheels positions and to analyze the relations between causes and effects of the motion parameters. The solution presented in the work allows to study the behavior of the platform both while wheels slippage and in the circumstances to refrain the platform from falling into the skid. The model can also be developed by introducing to the mathematical description other elements of the real object. "

Parameters of Selected Electro-Hydraulic Pilot Valves and a Discussion About Their Influence on the Control of a Hydraulic System in a Robotic Excavator

MAREK KAMIŃSKI
tendrugi@op.pl

This publication presents the results of research performed over a selected type of electro-hydraulic pilot valves used for positioning of a spool in a mobile hydraulics directional control valve (DCV). The assumption for this research was to focus on the mobile hydraulics DCVs (i.e. components that can practically be utilized in a robotic excavator application) because their performance, susceptibility to environmental factors, etc. are different than those of stationary hydraulic components. The DCV characteristics, basic dynamic parameters like step and sinusoidal input response and hysteresis were evaluated for different ranges of required output flow rate and dynamics of the DCV response. The results of this research were discussed in the context of using these DCVs for control of a robotic excavator taking into account the expected performance and typical operation scenarios of this type of machinery. The goal was to emphasize what are the key parameters that determine the possibility of using these valves in such application.

Eksperymentalna Identyfikacja Uszkodzeń W Kompozytowych Belkach z Wykorzystaniem Dystrybucji Czasowo-Częstotliwościowych

ANDRZEJ KATUNIN

Silesian University of Technology,Institute of Fundamentals of Machinery Design

Podejście oparte na dystrybucjach czasowo-częstotliwościowych zostało zaadaptowane do zagadnienia identyfikacji uszkodzeń w strukturach. Zaprezentowane podejście opiera się na analizie postaci własnych drgań belek kompozytowych z uszkodzeniami z wykorzystaniem dystrybucji czasowo-częstotliwościowych w celu identyfikacji bardzo małych niemonotoniczności i osobliwości spowodowanych uszkodzeniami, które implikują lokalny spadek sztywności struktury. Badania zostały przeprowadzone w oparciu o dane eksperymentalne, co pozwoliło na potwierdzenie efektywności zaproponowanego podejścia, włącznie z przypadkiem obecności szumu pomiarowego.

Influence of a Shape of Excitation Signal on the Character of Temperature Growth During Thermal Fatigue of Polymeric Composites

ANDRZEJ KATUNIN, ANGELIKA WRONKOWICZ, DOMINIK WACHLA

Silesian University of Technology,Institute of Fundamentals of Machinery Design

The paper presents results of theoretical investigation on the character of energy dissipation in composite structures subjected to cyclic loading with various shapes of excitation signals. Such loading implies the occurrence of the self-heating effect due to the hysteresis, occurred from viscoelasticity of a polymer. Results of theoretical analysis show the differences between investigated cases, namely sine, square, triangle and sawtooth excitation signals, and their influence on the intensification of structural degradation of polymeric composites. The theoretical results were verified experimentally on the laboratory stand.

Wpływ Kształtu Sygnału Wymuszenia na Charakter Wzrostu Temperatury Podczas Zmęczenia Cieplnego Kompozytów Polimerowych

ANDRZEJ KATUNIN, ANGELIKA WRONKOWICZ, DOMINIK WACHLA

Silesian University of Technology,Institute of Fundamentals of Machinery Design

Praca przedstawia wyniki badań teoretycznych nad charakterem dyssypacji energii w strukturach kompozytowych poddanych obciążeniom cyklicznym z różnymi kształtami sygnałów wymuszenia. Takie obciążenie powoduje występowanie efektu samorozgrzania ze względu na histerezę wynikającą z lepkosprężystości polimeru. Wyniki analizy teoretycznej wskazują na różnice pomiędzy rozpatrywanymi przypadkami, mianowicie sinusoidalny, prostokątny, trójkątny i piłokształtny sygnał wymuszenia, oraz ich wpływ na intensyfikację degradacji strukturalnej kompozytów polimerowych. Wyniki teoretyczne zostały zweryfikowane eksperymentalnie na stanowisku laboratoryjnym.

Experimental Damage Identification in Composite Beams Using Time-Frequency Distributions

ANDRZEJ KATUNIN

Silesian University of Technology,Institute of Fundamentals of Machinery Design

The time-frequency distributions-based approach was adapted for a structural damage identification problem. The presented approach is based on analysis of modal shapes of vibration of composite beams with damage sites using various time-frequency distributions in order to identify tiny non-monotonicities and singularities affected by damage, which imply local decrease of structural stiffness. The study was performed on experimental data, which allowed confirming the effectiveness of the proposed approach, including a case with presence of a measurement noise.

Enhanced Energy Recovery of a Vibration Absorber Using Dual Harvester Systems

KRZYSZTOF KECIK
k.kecik@pollub.pl

Lublin University of Technology

This paper proposes a novel type of a harvester – absorber system (HAS) designed for simultaneously vibration suppression and an energy recovery. The system consist of a four parts: a main system system (oscillator), a vibration absorber (pendulum), an electromagnetic levitation harvester and a rotatory energy generator. The first electromagnetic harvester device induced energy results from relative motion between a magnet and a coil. The second harvester is mounted in a pendulum suspension and consist of a stator and a rotor. The main aim of the paper is compare recovered energy from both harvester systems.

Evaluation of Electromechanical Coupling Parameters of the Railway Vehicle Electric Drive System to Condition Monitoring of the Drive

ROBERT KONOWROCKI

In the framework of studies there are presented results of numerical investigation of the electromechanical drive system of the railway vehicle. The electromechanical model gave us electrical parameters of a driving motor. Evaluation of the parameters can be used to create guidelines to a monitoring system. Main information about torsional vibrations of wheelsets generated by friction coefficient in the wheel-rail zone are provided by electric parameters obtained from a dynamic electromechanical drive model. The vibrations of wheelsets generated by a self-excited vibration mechanism of wheel-rail contact systems are very harmful. The proposed approach can be used to an alternative solution for monitoring of the torsion vibrations in considered drive system. The results of this analysis can be application in order to investigate the drive system's sensitivity to torsional oscillations.

Hot Bands on a Surface of Disc Brake Used in the High Speed Train-Experimental Investigation

ROBERT KONOWROCKI, JACEK KUKULSKI

The heat produced between friction couple during braking induces thermal distortion in the disc and leads to appearance of hot bands. The Hot bands are generated by thermoelastic phenomena appearing in systems with high energy dissipation like brake or clutch systems. Systems exposed to thermoelastic instabilities show a characteristic temperature distribution that can lead to local material change, vibrations of the braking system element or coefficient of friction fluctuations. In the framework of studies there are presented results of experimental investigation on influence of the hot bands on properties of friction pair elements and parameters of the high-speed train brake system.

Mode I Stress Intensity Factors for Surface Planar Cracks in Circular Bodies Under Rotary Bending

ROMAN KRÓL, PAWEŁ GRABOWSKI

Warsaw University of Technology, Institute of Construction Machinery Engineering

A method of calculating stress intensity factors, using point-load weight function, for two-dimensional surface cracks subjected to rotary bending, applied to circular objects is described in the paper. The research has regarded planar cracks in finite circular bodies, which may occur e.g. in shaft cross sections of belt-driven machines. This type of drive is widely spread in the technological lines, therefore the research on improving its fatigue durability is crucial for development of this branch of industry. One of a few advantages of the method which has been applied is the possibility to evaluate stress intensity factor (SIF) values precisely in a quick and simple way. The paper shows the computation for various parameters of shape and size of shafts and cracks. The presented method yields more conservative results compared to reference values obtained for the same configurations with the finite element method, which gives a good perspective to use such calculated SIFs for life assessment. Checking of these possibility is an essential issue of the work described in the paper.

Thin-Walled Energy Absorption Components: Preliminary Approach to Optimal Design Using Macro Element Modeling

MAREK KRZYWOBŁOCKI, MARIUSZ PYRZ
mpyrz@simr.pw.edu.pl

Warsaw University of Technology, Institute of Vehicles, Faculty of Automotive and Construction Machinery Engineering

The work presents the preliminary investigation devoted to the structural optimization of thin-walled energy absorption systems. The Macro Element Method (MEM) is applied to model large deformations and to calculate crushing parameters of thin-walled sections used in the car industry. Crashworthy calculations performed using MEM are incomparably faster than classic Finite Element solvers. The objective of this study is to find optimal dimensions of a beam cross-sections in order to maximize the energy absorbed by this component during the impact. Two optimization algorithms have been developed to determine the best solution. The first uses a modified version of the random search Monte Carlo method, the second is based on the Evolutionary Algorithm. Different thin-walled tubes exposed to the axial load are analyzed in numerical examples. The results of both approaches are compared and discussed. The potential of the optimization in early design stages of the vehicle development process is shown. The work prepares perspectives for the analysis of complex, real-life energy absorbing systems.

Research and Modelling of the Mechanical Properties of Magnetorheological Elastomers (MRES)

MATEUSZ KUKLA , JAN GÓRECKI, IRENEUSZ MALUJDA, KRZYSZTOF TALAŚKA, PAWEŁ TARKOWSKI

Poznan University of Technology,Chair of Basics of Machine Design

Magnetorheological elastomers is a group of smart composite materials that certain physical parameters can change under the influence of magnetic field. They are characterized by the combination of elastic properties of elastomers and magnetic properties of ferromagnetic materials. Main purpose of conducted research is to search for a new applications of magnetorheological elastomers. To this end studies of the influence of magnetic field on the mechanical properties of considered material were conducted. For this purpose static and cyclic compression test were performed. An attempt was made to use a viscoelastic Kelvin-Voigt model for describing the composite behaviour on the basis of the test results. An analysis of the influence of magnetic field on the various parameters of proposed model was also carried out.

Dynamic Analysis of Double Pendulum With Variable Mass in Dimensionless Coordinates

RAFAŁ KWIATKOWSKI, TADEUSZ J. HOFFMANN, ANDRZEJ KOŁODZIEJ

PWSZ w Kaliszu, Katedra Mechaniki i Budowy Maszyn

The article concerns considerations, whose the theme is to try to mathematical description and analysis of the study of the phenomenon of mass exchange between the members of double pendulum and its impact on the dynamics of the whole system. In the analyzed system, with time, under the influence of gravity, the mass of the upper member of pendulum decreases and the mass of the lower member of pendulum increases. The total mass of the system doesn't change. For the analysis introduced dimensionless time and dimensionless parameters, which allows the presentation of the equations of motion in dimensionless form. The article was analyzed both so-called mathematical pendulum as well as the so-called physical pendulum. It was compared dynamics of the mathematical pendulum in relation to the physical pendulum. It has been shown that the change of mass in the system has a significant impact on the dynamics. The increase in mass of the lower member reduces the amplitude of vibration of the pendulum. Numerical calculations and simulations of the generalized coordinates and the generalized velocities were performed in Mathematica package from Wolfram Research.

Selected Design Issues of Toggle Plate Selection on the Example of the Single Jaw Crusher

ARKADIUSZ KWAŚNIEWSKI, PAWEŁ CIĘŻKOWSKI

Politechnika Warszawska, Instytut Maszyn Roboczych Ciężkich

The goal of this study is to show the differences in the results of the simulation trajectory of the movable jaw of the single jaw crusher depending on the assumptions of design basing on toggle plate example. Calculations and simulations were carried out for the different locations of assembly boards and selected variants of the shape of the plates grinding demonstrated impact on the trajectory of the selected points of the plate crumbling. Simulations show that by appropriate selection of the kinematic transmission to the jaw can increase machine productivity as well as reduce the value of the work force and crushing.

Dynamic Tilt Measurements Using MEMS Accelerometers

SERGIUSZ ŁUCZAK
S.Luczak@mchtr.pw.edu.pl

Politechnika Warszawska, Wydział Mechtroniki

A problem of monitoring maximal tilt of a weight being lifted by means of a crane or a similar machinery is addressed. The tilt is to be measured by means of small, inexpensive and reliable MEMS accelerometers. Even though such measurement can be performed only under static or quasi-static conditions, in the considered case having a dynamic nature, it is still possible, since only a maximal value of the tilt is being monitored. However, the tilt must not be measured in terms of pitch and roll as it can occur within an arbitrary vertical plane. Instead, measurements of axial tilt should be performed.

Graphene as the Disperse Phase in the Polyamide Matrix

ANNA MAKUCH[1], MARCIN BAJKOWSKI[2], MARIA TRZASKA[1], KONSTANTY SKALSKI[1]
a.makuch1309@gmail.com

[1]Institute of Precision Mechanics, Warsaw,
[2]Warsaw University of Technology, Department of Construction Engineering and Biomedical Engineering

This paper presents the results of investigations into the development of a new composite material with polyamide matrix and multilayer graphene as the disperse phase. Consolidation of the new material was preceded by the selection of appropriate parameters of the process of preparation of powders (elements of composite material). Mechanical and structural properties of the new composite in form of PA-G strips were assessed at the microstructural level using nanoindentation test, optical techniques (3D microscope), X-ray diffraction (XRD) and scanning electron microscopy (SEM). The results of the tests showed that adopted technologies of production allow to obtain material with improved mechanical properties and homogeneous deployment of strengthening phase in the soft polyamide matrix. These features allow to apply new material in special constructions, especially in regard to load-bearing elements of small arms, butt and additional equipment.

Analysis of a Rotating Composite Beam With Piezoelectric Effect

ANDRZEJ MITURA, JAROSŁAW LATALSKI, JERZY WARMIŃSKI
a.mitura@pollub.pl

Lublin University of Technology, Department of Applied Mechanics

This study presents an analysis of a dynamic system consisting of a rigid hub and a cantilever flexible composite beam with bonded active piezoelectric element. The system is excited by the periodic oscillations of the hub angular speed. The embedded macro fiber composite active element is used to suppress beam vibrations. In the mathematical formulation of the problem non-classical effects like material anisotropy and mode coupling due to an arbitrary stacking sequence of the laminate as well as transverse shear deformation of the material are taken into account. Derived in previous research partial differential equations of the considered system are solved numerically by the finite difference method. Results of numerical analysis are compared to experimental data including modal analysis, frequencies of natural vibrations and responses to unit step function excitations. Finally, the effectiveness of the piezoelectric actuator and tested algorithms is evaluated.

Analysis of a Structural Model of an Orthotic Robot Hip Subsystem

DYMITR OSIŃSKI, MARCIN ZACZYK, DANUTA JASIŃSKA-CHOROMAŃSKA
d.osinski@mchtr.pw.edu.pl, m.zaczyk@mchtr.pw.edu.pl, danuta@mchtr.pw.edu.pl

Warsaw University of Technology, Faculty of Mechatronics

The paper describes a design solution for realizing turns of the lower limbs to be implemented in the 'Veni-Prometheus' orthotic robot, developed at the Division of Design of Precision Devices, Faculty of Mechatronics, Warsaw University of Technology. At the present stage of development, the system provides five basic functions: walking on a flat surface, going up or down the stairs, as well as sitting and standing up. Some works have been carried out, which aim was to enhance the motor capabilities of the device by a possibility of changing direction of motion, i.e. making turns. The paper presents a conception of the device that allows for additional degree of freedom of the lower limb. The system is located at the side of an immovable hip belt, and is connected with the thigh connector. DC motors, coupled with gears providing motion of the limb, drive it by means of worm gears responsible for driving flexion and extension motion as well as rotation The realized simulation studies enabled evaluation of chosen parameters of the structural model of the proposed module with respect to possibilities of its implementation in the System for Verticalization and Aiding the Motion for the disabled and patients suffering from a declined use of the lower limbs. A parametric model of the human body dependent on human mass and height was employed. Necessary torque of driving motors in two scenarios of turning motions was plotted. The realized simulation studies made it possible to determine the basic loads of the proposed mechanism dependently on the essential user's traits: his height and weight, influencing the derivative parameters, such as masses of particular members, their dimensions, mass moments of inertia and position of the gravity centers in the long axis of the limb.

The Study of the Positioning by Using Pneumatic Hybrid Drive

P. PERZ, I. MALUJDA, D. WILCZYŃSKI

Poznan University of Technology, Chair of Basics of Machine Design

Construction of the pneumatic positioning drive presented in this paper works differently from the already known methods of controlling positioning devices. It consists of double-acting piston rod cylinder and electromagnetic brake. Proposed hybrid positioning system enables easy programming of the actuator displacement. Presented solution had removed significant defects, that often occur in pneumatic positioning systems. Hybrid system provides maintaining the desired position and positioning with shorter times, higher velocity of the piston and higher precision. Steering system is build based on the measuring device NI PCI-6025 and software National Instruments.

Decentralized Stabilization of Vibrating Structures

DOMINIK PISARSKI

Instytut Podstawowych Problemów Techniki PAN

The work presents novel concepts of decentralized structural vibration control. The control is assumed to be realized by a semi-active device. The objective is to stabilize a vibrating system with the optimal rates of decrease of the energy. Two types of controllers, heuristic and optimal, are considered. Both controllers employ easy for implementation decentralized state-feedback structures. They utilize a set of communication channels to exchange the state information between the neighboring controllers. The performance of the designed controllers is validated by means of the numerical experiments performed for double cantilever system equipped with a set of elastomers with controlled viscoelastic properties. In terms of the assumed objectives, the proposed distributed method significantly outperforms the passive damping cases and is competitive to standard centralized control.

Renyi and Shannon Entropy as Tools by Failure Occurrence Detection

STANISŁAW RADKOWSKI
ras@simr.pw.edu.pl

Warsaw University of Technology, Institute of Vehicle

With today's high technology some life tests result in few failures by the end of experiment. Thus it is hard to use the classical reliability analysis to estimate remaining useful time.The tool to estimate the probability distribution changes corresponding to changes in the distribution of signal energy can be failure oriented measure of information. The paper discusses the problem of proper selection of entropy methods, for detecting and the identification of the failures, both for the signals generated by the actual dynamic systems and simulated one.

Oscillations of an Autoparametrical System With the Spherical Pendulum

DANUTA SADO, ANNA BOBROWSKA
dsa@simr.pw.edu.pl

Warsaw University of Technology, Institute of Machine Design Fundamentals

Dynamics properties of the three degree of freedom autoparametric system with spherical pendulum in the neighbourhood internal and external resonance are investigated. It was assumed that spherical pendulum is suspended to the main body which is suspended by the element characterized by elasticity and damping and is excited harmonically in the vertical direction. The spherical pendulum is similar to the simple pendulum, but moves in 3-dimensional space, so the model with spherical pendulum is more similar to the real systems then the model with simply pendulum. In this paper the position of the main body is described by coordinate z and position of the pendulum is describe by coordinate z and two angles: θ and ϕ in the vertical planes. This system has three degrees of freedom .Dynamics properties of the system described by three differential equations containing strongly nonlinear terms are investigated numerically. In autoparametric system one mode of vibration may excite or damp another one, and for except periodic or quasi-periodic vibrations there may also appear chaotic vibration. For characterizing an irregular chaotic response, time histories, bifurcation diagrams, power spectral densities, Poincaré maps and maximal exponents of Lyapunov have been developed.

Spiral Bevel Gears Milled on the 5-Axis CNC Machine

PIOTR SKAWIŃSKI, PRZEMYSŁAW SIEMIŃSKI
psk@simr.pw.edu.pl, p-sieminski@wp.pl

Warsaw University of Technology

The development of multi-axis numerically controlled milling machines and the development of software in computer aided manufacturing area led to the existence of new possibilities of CNC technological machines for general use. One of this area is milling of the teeth on the multi-axis CNC milling machines using standard milling tools as end mill tools. The paper present problems connected with processing of the teeth of spiral bevel gears cutted on the CNC milling machines.

Koła Zębate Stożkowe O Spiralnej Linii Zęba Wykonywane Na 5-Osiowych Frezarkach Cnc

PIOTR SKAWIŃSKI, PRZEMYSŁAW SIEMIŃSKI
psk@simr.pw.edu.pl, p-sieminski@wp.pl

Warsaw University of Technology

Rozwój wieloosiowych sterowań numerycznych frezarek, a także rozwój oprogramowania narzędziowego z obszaru komputerowo wspomaganego wytwarzania spowodował zaistnienie nowych możliwości maszyn technologicznych CNC ogólnego przeznaczenia. Takim nowym obszarem jest frezowanie uzębienia kół zębatych na wieloosiowych frezarkach CNC przy zastosowaniu również typowych narzędzi frezarskich jakimi są frezy palcowe. Referat przedstawia problematykę związaną z obróbką uzębienia stożkowych kół zębatych o spiralnej linii zęba na wieloosiowych frezarkach CNC.

Transverse and Longitudinal Damped Vibrations of T-Type Frame

WOJCIECH SOCHACKI
sochacki@imipkm.pcz.pl

Politechnika Częstochowska, Instytut Mechaniki i Podstaw Konstrukcji Maszyn

In work, the influence of different kinds of damping on transverse and longitudinal vibrations of T type frame was formulated and solved. Damping in adopted model is a result, of taken into account internal damping of viscoelastic material of beams that model the system, external viscous damping and constructional damping. Constructional damping occurs as a result of movement resistance in the supports and it was modelled by the system of rotational viscous damper and rotational spring with linear characteristic. The boundary problem connected to the free vibrations of the considered non-conservative (due to damping) system was formulated on the basis of Hamilton's principle. The results of numerical research taking into consideration influence of changes in geometry of the system and the variable values of damping coefficient and spring rigidity coefficient were presented in 2D figures and spatial presentations."

Variational and Numerical Analysis of Two Contact Problems

MIRCEA SOFONEA, MIKAEL BARBOTEU
sofonea@univ-perp.fr, barboteu@univ-perp.fr

University of Perpignan Via Domitia, 52 Avenue Paul Alduy, 66860 Perpignan, France

We present two mathematical models which describe the contact between an elastic body and a rigid foundation covered by a deformable layer made of soft material. The first model is frictionless and the second one is frictional. We study the models in the form of a variational-hemivariational inequality for the displacement field. We review theoretical results concerning their unique solvability and numerical solution. Then, we present numerical simulation in the study of two-dimensional academic examples together with various mechanical interpretations.

Influence of Manner of Coupling the Power Train of the Prototype Mobile Platform on the Conditions of the Rolling Friction Between the Drive Wheel and the Ground

SZCZEPAN ŚPIEWAK
szczepan_spiewak@poczta.onet.pl

Czestochowa University of Technology

The research subject is an author's design solution of a wheel transporter. Original structure of the power train, between the electric drive motor and the drive wheel, has been described in this work. The platform will be used for the analysis of dynamic interactions and their impact on motion which will provide the basis for defining the control settings of drive units of the power train and the steering system. Solution of the power train shown in the work provides the ability to uncouple selected drive units and to study motion trajectory in follower motion when the stub axles are immobilized. The consequence of the adopted solution is a specific distribution of contact pressures in the contact zone between the drive wheel and the ground, which is dependent both on the load of the platform, but primarily on whether a wheel is coupled to the drive unit and will be a follower system. This effect appropriately reflects both the resistance of rotational motion of the drive wheel and the resistances associated with the positioning of the steering system of the platform. The article describes the FEM model used in the analysis.

Lokalna i Globalna Niestateczność Układów Geometrycznie Nieliniowych z Elementem Niepryzmatycznym Przy Obciążeniu Eulera

JANUSZ SZMIDLA, ANNA JURCZYŃSKA

Politechnika Częstochowska, Instytut Mechaniki i Podstaw Konstrukcji Maszyn

W pracy przedstawiono rozważania teoretyczne oraz obliczenia numeryczne dotyczące stateczności układów geometrycznie nieliniowych z elementem niepryzmatycznym. Analizowane kolumny poddane zostały działaniu różnych przypadków obciążenia Eulera (zmienne warunki brzegowe). Na podstawie zasady minimum energii potencjalnej oraz metody małego parametru sformułowano różniczkowe równania przemieszczeń oraz wyznaczono ich rozwiązania. W pracy przyjęto, że aproksymacja kształtu elementu niepryzmatycznego spełnia warunek stałej objętości wynikającej ze współczynnika asymetrii rozkładu sztywności na zginanie układu geometrycznie nieliniowego. Wyniki przeprowadzonych symulacji numerycznych odnoszą się do zagadnienia lokalnej i globalnej utraty stateczności. Wykazano, że uwzględnienie w układzie geometrycznie nieliniowym odpowiednio ukształtowanego pręta o zmiennym przekroju poprzecznym powoduje wzrost przenoszonego obciążenia bifurkacyjnego oraz „wyjście" układu z zakresu lokalnej niestateczności (utrata prostoliniowej postaci równowagi statycznej).

Drgania Swobodne Układu Niepryzmatycznego Realizującego Obciążenie Swoiste z Uwzględnieniem Podatnych Węzłów Konstrukcyjnych

JANUSZ SZMIDLA, ANNA JURCZYŃSKA

Politechnika Częstochowska, Instytut Mechaniki i Podstaw Konstrukcji Maszyn

Praca dotyczy zagadnienia drgań swobodnych pręta niepryzmatycznego poddanego działaniu wybranego przypadku obciążenia swoistego. W przeprowadzonych badaniach uwzględniono podatność węzłów konstrukcyjnych analizowanego układu, zamodelowanych za pomocą sprężyn translacyjnych umieszczonych w zamocowaniu lub przy swobodnym końcu. Kształt pręta aproksymowano za pomocą funkcji liniowej oraz wielomianu II stopnia, przy zachowaniu warunku stałej objętości. Po uprzednim zdefiniowaniu całkowitej energii mechanicznej, w oparciu o zasadę Hamiltona sformułowano różniczkowe równania ruchu oraz warunki brzegowe. Wyniki obliczeń numerycznych określają wpływ zmiennego przekroju poprzecznego pręta, podatności węzłów konstrukcyjnych oraz geometrii struktury wymuszającej obciążenie na częstości drgań własnych przy zmiennym obciążeniu zewnętrznym (krzywe charakterystyczne) oraz obciążenie krytyczne.

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JANUSZ SZMIDLA
j.szmidla@imipkm.pcz.pl

Instytut Mechaniki i Podstaw Konstrukcji Maszyn, Politechnika Częstochowska

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Lokalna i Globalna Niestateczność Układów Geometrycznie Nieliniowych z Elementem Niepryzmatycznym przy Obciążeniu Eulera

JANUSZ SZMIDLA
j.szmidla@imipkm.pcz.pl

Instytut Mechaniki i Podstaw Konstrukcji Maszyn, Politechnika Częstochowska

W pracy przedstawiono rozważania teoretyczne oraz obliczenia numeryczne dotyczące stateczności układów geometrycznie nieliniowych z elementem niepryzmatycznym. Analizowane kolumny poddane zostały działaniu różnych przypadków obciążenia Eulera (zmienne warunki brzegowe). Na podstawie zasady minimum energii potencjalnej oraz metody małego parametru sformułowano różniczkowe równania przemieszczeń oraz wyznaczono ich rozwiązania. W pracy przyjęto, że aproksymacja kształtu elementu niepryzmatycznego spełnia warunek stałej objętości wynikającej ze współczynnika asymetrii rozkładu sztywności na zginanie układu geometrycznie nieliniowego. Wyniki przeprowadzonych symulacji numerycznych odnoszą się do zagadnienia lokalnej i globalnej utraty stateczności. Wykazano, że uwzględnienie w układzie geometrycznie nieliniowym odpowiednio ukształtowanego pręta o zmiennym przekroju poprzecznym powoduje wzrost przenoszonego obciążenia bifurkacyjnego oraz „wyjście" układu z zakresu lokalnej niestateczności (utrata prostoliniowej postaci równowagi statycznej).

Influence of Electromagnetic Actuators on Near-Critical Behaviour of a Pipe Conveying Fluid

TOMASZ SZMIDT, ROBERT KONOWROCKI

Polish Academy of Sciences, Institute of Fundamental Technological Research

Application of electromagnetic actuators to stabilize a pipe conveying fluid is investigated. When the flow velocity becomes sufficiently high the pipe loses stability. The energy supplied in a non-periodic form is transformed by the system into its oscillatory motion. Electromagnetic actuators of transformer type are investigated in the study. The non-linear ordinary differential equations governing the state of the actuators are presented. The continuous problem of dynamic stability of the pipe is discretized with the multimodal Galerkin procedure. It is shown that the actuators enable one to increase the critical flow velocity. Afterwards, a non-linear analysis of the Hopf bifurcation that occurs in the system is performed. Although the analysis is confined to purely numerical simulations, the physical parameters of the system are selected in a way that will allow conducting experimental verification, which is the next stage of this research project.

Calibration of the Microsoft Kinect Device Fitted With Nyko Zoom Attachment Used in a Three-Axis Manipulator

TARKOWSKI PAWEŁ, MALUJDA IRENEUSZ, TALAŚKA KRZYSZTOF, KUKLA MATEUSZ, GÓRECKI JAN

Poznan University of Technology,Chair of Basics of Machine Design

Presented method describes processing of the data obtained from Microsoft Kinect device fitted with Nyko Zoom attachment. This system is used to obtain the geometric dimensions of items placed in the workspace of prototype glue spraying machine. The presented data acquisition method allows to describe the shape of the surface and accurately determine the item position. The paper deals with processing of information on the registered object changed by the used attachment. The lens allowed to increase the angle of view of the Kinect device while reducing the minimum working distance. Modified optics generates barrel distortion. Using this method you can determine the height, width, depth of the element and its exact position and rotation. Included in the working method of correction is the solution to the problem presented to the constant exposure of the background. The described solution is used as a subsystem for the identification of seats and can be used in designing a subsystem to calculate the trajectory of the spraying head.

Critical Spin Rate of Rotating Nanobeams by Liapunov's Direct Method

ANDRZEJ TYLIKOWSKI
aty@simr.pw.edu.pl

Warsaw University of Technology

The in-plane and out-of-plane buckling of a nanobeam subjected to axial loads due to a steady rotation are examined. The modified nonlocal beam model is used to describe both cases of buckling. The critical spin rate which will cause the nanobeam to buckle is derived as a function of nanobeams mechanical parameters, an additional axial force and the nanoscale coefficient.

Mechanical Properties Study of Natural Polymers

DOMINIK WILCZYŃSKI, IRENEUSZ MALUJDA, KRZYSZTOF TALAŚKA
dominik.wilczynski@put.poznan.pl, ireneusz.malujda@put.poznan.pl krzysztof.talaska@put.poznan.pl

Poznan University of Technology

The investigations relates to the material in the form of post-fermentation sediment and coconut husk. The test results include seasoning in a climatic chamber and measure the compression force as a function of displacement for different values of moisture content. On this basis, the degree of densification changes depending on the humidity of the sample was identified. Subsequently tests were carried out aiming at determining the coefficient of friction between the compacted material heated to the desired temperature, and the steel plate. The temperature values were similar to the values of temperature for biomass material during agglomeration process.

Drive Selection of Walking Robot Leg Based on Its Dynamic Model

WOJTKOWIAK D., MALUJDA I., TALAŚKA K.

Poznan University of Technology, Chair of Basics of Machine Design

Using dynamic model of the walking robots leg can be very helpful during the process of its design. It is most important during the stage of drive selection. In order to achieve desired motion of the walking robots foot we need to provide accurate torque to its movable joints. This value can be simply calculated from the equations of motion. The goal of this paper is to show above described methodology. Lot of parameters such as mass, moment of inertia, flexibility and damping coefficient of each component of the analyzed leg are needed to derive detailed dynamic model of the walking robot leg. Preliminary selection of the drives should be made based on the static reaction torques in joints of the kinematic structure. Then by using Lagrange method we can derive the equations of motion and possible correction of drive selection. Dynamic model presented in this article is made based on the kinematic structure of hexa-quad bimorph walking robots leg. It contains certain assumptions, which are made in order to simplify the model. By combining this model with position, velocity and acceleration charts we can gain information about necessary dynamic drive torque, which can be used in its steering process.

Typy Uszkodzeń i Metody Badań Nieniszczących Kompozytów Warstwowych: Przegląd

ANGELIKA WRONKOWICZ

Silesian University of Technology, Institute of Fundamentals of Machinery Design

Praca przedstawia przegląd typów wad występujących w kompozytach warstwowych oraz powszechnie stosowanych metod badań nieniszczących takich struktur. Pierwsza część zawiera krótki opis dwóch grup wad materiałów kompozytowych: produkcyjnych oraz eksploatacyjnych. Szczególną uwagę skupiono na niskoenergetycznych uszkodzeniach udarowych oraz omówiono ich przyrost pod wpływem obciążeń eksploatacyjnych. Druga część pracy poświęcona jest klasyfikacji metod wykrywania wad w kompozytach warstwowych. Najbardziej uniwersalna metoda, tj. badanie ultradźwiękowe, została uwypuklona w pracy i szczegółowo omówiona. Ponadto, została opisana istota stosowania algorytmów przetwarzania obrazów w badaniach nieniszczących wraz z wybranymi wynikami autorki.

Types of Defects and Nondestructive Testing Methods of Layered Composites: A Review

ANGELIKA WRONKOWICZ

Silesian University of Technology, Institute of Fundamentals of Machinery Design

The paper presents a review on the types of defects occurring in layered composites as well as the commonly applied nondestructive testing methods of such structures. The first part includes a short description of two groups of defects of composite materials: the manufacturing and the in-service ones. A special attention is paid to the so-called barely visible impact damage and its progression under operation loading is discussed. The second part of the paper is devoted to classification of methods of detection of defects in layered composites. The most universal method, namely the ultrasonic testing, was highlighted in the paper and discussed in more detail. Moreover, a significance of application of image processing algorithms in nondestructive testing with selected results of the author in this area was also described.

Measurement System for Special Surface Mapping Using Displacement Sensors

MARTYNA ZOWADE, MACIEJ BODNICKI

Warsaw University of Technology

The aim of the work was to design a special system for measurements of elements with repetitive geometry or assemblies with repeating components, set in a linear patterns. The main focus was based on developing a computer program for signal analysis from variable number of miniature displacement sensors. It was set that the response for displacement of measuring tip from each sensor was a 0-5V voltage signal with possibility of using different type of sensors.

The Problem of Cooperation of Timing Belt With Elements of Power Transmission and Conveying Systems

GRZEGORZ DOMEK[1], ANDRZEJ KOŁODZIEJ[2], MICHAŁ WILCZYŃSKI

[1]UKW Bydgoszcz [2]PWSZ Kalisz

ABSTRACT A timing belt in power transmission and conveying systems cooperates with several elements consisting of timing pulleys, tensioners or guiding rails. Expectations concering coeficient of friction vary according to application. They depend strongly on characteristics of the process as well as the type of friction. In recent constructions, producers of timing belts are very much concerned about achieving as much slippery surface as possible. The work describes the problem of friction on different surfaces as well as its influence on gear lifetime. Research results confirm that on many surfaces bigger coefficient of friction is expected.

Design of Special Testing Device for the Measurement Office

DUDZIAK M.[1], KOŁODZIEJ A.[1], TALAŚKA K.[2], WILCZYŃSKI D.[2]

[1]The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz
[2]Poznan University of Technology, Chair of Basics of Machine Design

In paper construction process of special device for calibration of portable scales was presented. The presented results of realisation of construction process contain analysis of knowledge state, develop of assumptions and results of numerical analysis. These analysis are the basis for determining of geomtrical parameters of machine elements. The presented results contain also presentation of physical realisation of this device as implemented for use. The presented results are important for the development of the knowledge necessary to methodological design and modelling of the geometrical features of machines. For example shape, size, type of material, load distribution and functionality. Based on the obtained results and received experiences the project team has developed an innovative concept for a compact device with mechatronically controlled measuring cycles.

Selection of Crucial Geometrical Features During Cylindrical Connections Modelling

MARIAN DUDZIAK, ANDRZEJ KOŁODZIEJ, KRZYSZTOF TALAŚKA

The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz

The assemblies of machine parts with deviations such as radial deviations, deviations of a cross section and their compilations have variable values of local stresses and displacements. The type of form deviations and their values play a key role in design process and then in machine operation. A test stand with an extensometer for measuring the axial friction force and moment of friction is presented. The experimental investigations have been conducted in order to determine the influence of form deviations on the values of axial friction force (during displacement of shaft) and moment of friction (during rotation of shaft). The issue of contact problems has been presented for numerical simulation of contact between a three-angular shaft with a saddleback distortion (with variable value of cross section deviation) and a rigid hole - the shaft was placed in different angular positions. The occurrence of variable relative and contact stresses and resistance of axial movement and rotation of the shaft has been showed.

Investigation of the External Friction Factor for Agglomerated Dry Ice

GÓRECKI J., MALUJDA I., TALAŚKA K.

Poznan University of Technology, Chair of Basics of Machine Design

This paper presents the results of material research of crystallized carbon dioxide. Research has been focused on the determination of the value of external friction factor for agglomerate dry ice. Material is characterized by low temperatures and the tendency to sublimate occurring at ambient conditions. To conduct research with so peculiar properties of a material was developed special research methodology which allowed execution of described experiment. This allowed us to derive assumptions, which can become the starting point of the process to build a mathematical model, which describe the dry ice compaction and granulation processes. Also friction factor is the basis for the formulation of effective design principles, which are the starting point for the construction of machines for densification and granulation of dry ice.

Reduced Stresses in Magnetoelasticity

TADEUSZ J. HOFFMANN, RADOSŁAW PYTLIŃSKI, MICHAŁ POŚPIECH

PWSZ Kalisz

In this paper the phenomena occurring in the high-voltage cables were described. One of the causes that the analysis of the electromagnetic fields in the wires and its surrounding is important is the electromagnetic compatibility. The model of infinitely long cable, where it is assumed that the length of the cable is much bigger than its external diameter and the current intensity is constant, was used for calculations. Thanks to the above assumptions the intensity of magnetic field, the components of Maxwell stress tensor and magnetoelastic strains in all the layers were determined. Complex stress states were shown in the form of reduced stresses according to the failure criteria of Tresca-Guest and Huber-von Mises-Hencky. The results are presented on the 3D graphs in Mathematica by Wolfram Research Inc.

Analiza Numeryczna i Eksperymentalna Nierównomierności Nacisków w Hamulcach Wielotarczowych

JERZY JACHIMOWICZ, MAREK PIETRZAKOWSKI, MARIUSZ SADOWSKI

Podczas pracy hamulców wielotarczowych może występować znaczna nierównomierność nacisków pomiędzy dociśniętymi tarczami. W artykule przedstawiono analizę numeryczną tego zagadnienia (z zastosowaniem Metody Elementów Skończonych) oraz analizę eksperymentalną (z zastosowaniem badań modelowych na stanowisku bezwładnościowym). Rozpatrzono wpływ imperfekcji kontaktujących się powierzchni na rozkład nacisków oraz pól temperatur.

Determining Synchronization Thresholds in Arrays of Coupled Friction Oscillators

MICHAŁ MARSZAL, ANDRZEJ STEFAŃSKI
michal.marszal@p.lodz.pl

Lodz University of Technology, Division of Dynamics

Synchronization thresholds in systems of coupled dry friction oscillators with kinematic excitation coupled by linear springs are investigated. A classic dry friction stick-slip oscillator is used. The friction, occurring at the belt-mass interface, is modeled using exponential friction model. Single oscillators are coupled in networks of various length by means of nearest neighbor coupling topology in open and closed rings. We study numerically the dynamics of the obtained systems, particularly the synchronization thresholds (i.e. values of coupling parameters for which the synchronization occurs. We are interested in complete synchronization (when the dynamics of all oscillators converge), as well as cluster synchronization (when only dynamics of certain subsets converge). In order to predict the synchronization thresholds for complete synchronization a reference probe of two coupled oscillators is applied, alongside a master stability function (MSF). Additionally, a parameter study in two dimensional space (coupling strength vs. excitation angular frequency) is performed in order to find the regions of complete synchronization and cluster synchronization. It is shown that complete synchronization occurs under certain circumstances, and so does the cluster synchronization. The obtained results have confirmed that the MSF technique can be applied for the systems with discontinuities, such as stick-slip oscillator.

Mutual Sliding of Working Surfaces Is a an Essential Element of a Needle Bearing's Function
Poślizg Wzajemny Powierzchni Roboczych jako Nieodzowny Element Pracy Łożysk Igiełkowych

JERZY NACHIMOWICZ[1], ROBERT KORBUT[2]
j.nachimowicz@pb.edu.pl, robert.korbut@gmail.com

[1]Bialystok University of Technology, Faculty of Mechanical Engineering,
[2]Wizard Robert Korbut

W opracowaniu przedstawiono kinematykę pracy węzła ciernego na przykładzie łożyskowania igiełkowego. W części teoretycznej zestawiono czynniki mające wpływ na części składowe sumarycznego momentu oporu ruchu pracy łożyskowania – poślizg, mikropoślizg i toczenie. Szczególną uwagę skupiono na zjawisku wzajemnego poślizgu powierzchni roboczych współpracujących w węźle ciernym. Przeprowadzone badania oraz analiza wyników wskazuje nam obszar czynnej pracy łożyska, udział poślizgu w strefie obciążenia oraz rodzaj i czynniki zużycia w badanych parach tarciowych. Określenie warunków zużycia w badanych parach ciernych pozwoli nam świadomie podnosić trwałość eksploatacyjną łożyskowań igiełkowych.

Mutual Sliding of Working Surfaces Is a an Essential Element of a Needle Bearing's Function

JERZY NACHIMOWICZ[1], ROBERT KORBUT[2]
j.nachimowicz@pb.edu.pl, robert.korbut@gmail.com
[1]Bialystok University of Technology, Faculty of Mechanical Engineering,
[2]Wizard Robert Korbut

The paper presents the kinematics of the friction pair on the example of a needle bearing. In the theoretical part we summarize the components of the summary resistance torque in working bearing - slip, micro-sliding and turning. Particular attention is focused on the phenomenon of mutual slip work surface cooperating friction pair. The study and analysis of the results shows us an area of active bearing operation, the share slip in the load zone and the type wear in the studied pairs friction. Defining the conditions wear in the studied pairs of friction will allow us to consciously improve the service life of the bearings needle.

Bench Testing of Self-Healing Structures

TOMASZ NOWAK, JACEK DYBAŁA, JAROSŁAW SEŃKO

Warsaw University of Technology, Institute of Vehicles

Design of modern means of transport requires the use of modern technologies, materials and system solutions. Problems of damage of material (on the surface and inside the material) are often discussed in the research area of automotive industry. In this context the technology of self-healing structures looks very interesting. This technology is the subject of intensive research in research institutes located in the USA, Germany, China and Japan. The big interest in this technology has its origin in the vast potential of application and implementation of this technology. Despite intensive research, the technology of self-healing structures still appears as an area little known. The article presents the test stand used for testing of self-healing structures and the methodology of this research. The paper has been prepared basing on tests carried out under the project No PBS3/A9/30/2015 "Technologies autonomous reconfiguration of materials in vehicles" financed by the National Centre of Research and Development (NCBiR).

Aviation Structure With a Magnetorheological Elastomer

PAWEŁ SKALSKI

Institute of Aviation

Magnetorheological elastomers have a big potential in the implementation in transport. In the aviation, often new solutions of construction with new materials are applied. The aim of this paper is to present a new solution of structure using a magnetorheological elastomer.

Struktura Lotnicza z Elastomerem Magnetoreologicznym

Elastomery magnetoreologiczne mają duże możliwości zastosowań w transporcie. W technice lotniczej często są stosowne nowe rozwiązania konstrukcyjne zawierające nowe materiały. Celem pracy jest zaprezentowanie nowego rozwiązania struktury lotniczej z elastomerem magnetoreologicznym.

Test Stand for Investigations of Magnetorheologial Elastomers

PAWEŁ SKALSKI

Institute of Aviation

The goal of this paper is to present a test stand for investigations of magnetorheological elastomers. In the paper the test stand, also the principle of operation, and examples of results from experiments are presented.

Stanowisko do Badań Elastomerów Magnetoreologicznych

Celem pracy jest zaprezentowanie stanowiska badawczego do wyznaczania krzywej histerezy dla elastomerów magnetoreologicznych. W pracy przedstawiono schemat stanowiska, jego zasadę działania, oraz przykładowe wyniki ze zrealizowanych badań.

Application of Magnetorheological Elastomers in Automotive Industry

PAWEŁ SKALSKI

Warsaw University of Technology, Institute of Vehicles

The aim of the paper is to show a state of the art in presented subject. In automotive industry the new solutions with magnetorheological elastomers are patented. Solutions with magnetorheological elastomers will be applied in new cars aimed to better comfort and safaty of the passengers in the near future.

Zastosowanie Elastomerów Magnetoreologicznych w Przemyśle Motoryzacyjnym

Celem pracy jest przedstawienie aktualnego stanu wiedzy w zakresie prezentowanego tematu. W przemyśle motoryzacyjnym coraz częściej patentowane są nowe rozwiązania zawierające w swojej budowie elastomery magnetoreologiczne. Rozwiązania z elastomerami magnetorelogicznymi w niedalekiej przyszłości będą stosowne w nowych samochodach celem podniesienia komfortu podróżnych jak i ich bezpieczeństwa.

The Examination of the Impact of Base Technology Parameters on the Geometry of the Teeth of Spiral Bevel Gears

PIOTR SKAWIŃSKI[1], MAREK KRET[2]
psk@simr.pw.edu.pl, marek.kret.pw.@gmail.com

[1]Instytut Podstaw Budowy Maszyn, Wydział Samochodów i Maszyn Roboczych,
[2]Engineering Design Center, General Electric

In the study has been analyzed the impact of basic technology parameters on the tooth geometry of spiral bevel gears milled by spiral generated modified roll method. Examined the impact of total modification factor K_p on the parameters of basic technology. The aim was to determine and identify the range of variation of parameters such as roll ratio, hypoid offset, radial setting, etc. on the geometry of spiral bevel gears.

Wpływ Parametrów Technologii Bazowej na Geometrię Uzębienia Spiralnych Przekładni Stożkowych

W pracy przeanalizowano wpływ parametrów technologii bazowej na geometrię uzębienia spiralnych przekładni stokowych nacinanych metodą modyfikowanego odtaczania. Rozpatrzono wpływ sumarycznego współczynnika modyfikacji K_p na parametry technologii bazowej. Celem było wyznaczenie i wskazanie zakresu zmienności parametrów takich jak przełożenie odtaczania, przesunięcie hipoidalne, ustawienie promieniowe, itp. na geometrię uzębienia przekładni stożkowej kołowo-łukowej.

List of authors:

Name	Affiliation	e-mail
Abide Stéphane	University of Perpignan Via Domitia	stephane.abide@univ-perp.fr
Andrzej Tylikowski	Warsaw University of Technology	aty@simr.pw.edu.pl
Bajer C. I.	Instytut Podstawowych Problemów Techniki PAN	
Bajkowski J. M.	Politechnika Warszawska	
Bajkowski Marcin	Warsaw University of Technology	granada@pompy.pl
Bartkowski Piotr	Warsaw University of Technology	bartkowski_piotr@onet.pl
Berdychowski M.	Poznan University of Technology	
Bobrowska Anna	Warsaw University of Technology	
Bodnicki Maciej	Warsaw University of Technology	
Bold Marta	Czestochowa University of Technology	bold@imipkm.pcz.pl
Bąk Sebastian	Warsaw University of Technology	sebastian.bak@simr.pw.edu.pl
Cekus Dawid	Politechnika Częstochowska	cekus@imipkm.pcz.pl
Chodkiewicz Paweł	Warsaw University of Technology	pawel@chodkiewicz.com.pl
Ciężkowski Paweł	Warsaw University of Technology	pawel.ciezkowski@simr.pw.edu.pl
Domek Grzegorz	UKW Bydgoszcz	
Dudziak Marian	The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz	
Dybała Jacek	Warsaw University of Technology	
Dyniewicz B.	Instytut Podstawowych Problemów Techniki PAN	
Florentin Eric	INSA Centre Val de Loire	eric.florentin@insa-cvl.fr

Name	Affiliation	e-mail
Grabowski Paweł	Warsaw University of Technology	
Grygoruk Roman	Warsaw University of Technology	r.grygoruk@wip.pw.edu.pl
Gumiński Robert	Warsaw University of Technology	
Górecki Jan	Poznan University of Technology	
Hoffmann Tadeusz J.	PWSZ w Kaliszu	
Jachimowicz Jerzy		
Jankowiak Artur	Warsaw University of Technology	
Jarosław Latalski	Lublin University of Technology	
Jasińska-Choromańska Danuta	Warsaw University of Technology	danuta@mchtr.pw.edu.pl
Jasiński Marcin	Warsaw University of Technology	
Jaskot A.	Częstochowa University of Technology	
Jerzy Warmiński	Lublin University of Technology	
Jurczyńska Anna	Politechnika Częstochowska	
Kamiński Marek		tendrugi@op.pl
Katunin Andrzej	Silesian University of Technology,Institute of Fundamentals of Machinery Design	
Kecik Krzysztof	Lublin University of Technology	k.kecik@pollub.pl
Konowrocki Robert		
Konowrocki Robert	Polish Academy of Sciences	
Konstanty Skalski	Institute of Precision Mechanics, Warsaw	
Korbut Robert	Bialystok University of Technology	robert.korbut@gmail.com
Kołodziej Andrzej	The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz	

Name	Affiliation	e-mail
Kret Marek	Engineering Design Center, General Electric	marek.kret.pw.@gmail.com
Krzywobłocki Marek	Warsaw University of Technology	
Król Roman	Warsaw University of Technology	
Kukla Mateusz	Poznan University of Technology	
Kukulski Jacek		
Kwaśniewski Arkadiusz	Warsaw University of Technology	
Kwiatkowski Rafał	PWSZ w Kaliszu	
Lengiewicz Jakub	IPPT PAN	jleng@ippt.pan.pl
Łuczak Sergiusz	Politechnika Warszawska	S.Luczak@mchtr.pw.edu.pl
Makuch Anna	Institute of Precision Mechanics, Warsaw	a.makuch1309@gmail.com
Malujda Ireneusz	Poznan University of Technology	
Marszal Michał	Lodz University of Technology	michal.marszal@p.lodz.pl
Mielniczuk J.,	Rail Vehicles Institute "TABOR"	
Mikael Barboteu	University of Perpignan Via Domitia	barboteu@univ-perp.fr
Mircea Sofonea	University of Perpignan Via Domitia	sofonea@univ-perp.fr
Mitura Andrzej	Lublin University of Technology	a.mitura@pollub.pl
Nachimowicz Jerzy	Bialystok University of Technology	j.nachimowicz@pb.edu.pl
Nowak Tomasz	Warsaw University of Technology	
Osiński Dymitr	Warsaw University of Technology	d.osinski@mchtr.pw.edu.pl
Perz P.	Poznan University of Technology	
Pietrzakowski Marek		
Pisarski Dominik	Instytut Podstawowych Problemów Techniki PAN	

Name	Affiliation	e-mail
Posiadała B.	Częstochowa University of Technology	bogdan.p@imipkm.pcz.pl
Pośpiech Michał	PWSZ Kalisz	
Przerwa Piotr	Warsaw University of Technology	
Pyrz Mariusz	Warsaw University of Technology	mpyrz@simr.pw.edu.pl
Pytliński Radosław	PWSZ Kalisz	
Radkowski Stanisław	Warsaw University of Technology	ras@simr.pw.edu.pl
Radomski Marek	Warsaw University of Technology	mr@wip.pw.edu.pl
Sado Danuta	Warsaw University of Technology	dsa@simr.pw.edu.pl
Sadowski Mariusz		
Seńko Jarosław	Warsaw University of Technology	
Siemiński Przemysław	Warsaw University of Technology	p-sieminski@wp.pl
Skalski Paweł	Institute of Aviation	
Skalski Paweł	Warsaw University of Technology	
Skawiński Piotr	Warsaw University of Technology	psk@simr.pw.edu.pl
Skrobek Dorian	Politechnika Częstochowska	skrobek@imipkm.pcz.pl
Sochacki Wojciech	Czestochowa University of Technology	sochacki@imipkm.pcz.pl
Stefański Andrzej	Lodz University of Technology	
Szmidla Janusz	Politechnika Częstochowska	j.szmidla@imipkm.pcz.pl
Szmidt Tomasz	Polish Academy of Sciences	
Śpiewak Szczepan	Czestochowa University of Technology	szczepan_spiewak@poczta.onet.pl
Talaśka Krzysztof	Poznan University of Technology	
Talaśka Krzysztof	The President Stanisław Wojciechowski State University of Applied Sciences in Kalisz	

Name	Affiliation	e-mail
Tarkowski Paweł	Poznan University of Technology	
Trzaska Maria	Institute of Precision Mechanics, Warsaw	
Wachla Dominik	Silesian University of Technology,Institute of Fundamentals of Machinery Design	
Wilczyński Dominik	Poznan University of Technology	
Wilczyński Michał	PWSZ Kalisz	
Wojtkowiak D.	Poznan University of Technology	
Wronkowicz Angelika	Silesian University of Technology,Institute of Fundamentals of Machinery Design	
Zaczyk Marcin	Warsaw University of Technology	m.zaczyk@mchtr.pw.edu.pl
Zalewski Robert	Warsaw University of Technology	robertzalewski@wp.pl
Zeghmati Belkacem	University of Perpignan Via Domitia	zeghmati @univ-perp.fr
Zowade Martyna	Warsaw University of Technology	

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