6423-020

Wind tunnel tests for a flapping wing model with changeable camber using macro-fiber composite actuators

JaeHung Han, DaeKwan Kim, Korea Advanced Institute of Science and Technology(Republic of Korea); KiJung Kwon, Korea Aerospace Research Institute(Republic of Korea)

In the present study, a biomimetic flapping wing has been developed by using graphite-epoxy composite frames, a flexible PVC film, and macro-fiber composite (MFC) actuators. Using the actuators, the maximum camber of the wing can be linearly changed from -2.6 % to +4.4 % of the chord length like a bird. In order to investigate the aerodynamic characteristics and the flow pattern around the flapping wing, wind tunnel tests and particle image velocimetry tests are carried out in a low-speed wind tunnel. Although the chord-wise wing flexibility reduces an effective angle of attack, the maximum lift coefficient can be increased by the MFC actuators up to 24.4 % and 20.5 % in static and dynamic test conditions, respectively. Especially, due to a leading edge vortex attached on the wing surface, the maximum lift and thrust coefficients increase remarkably more than 5 in unsteady flight region. The stable leading edge vortex can be maintained by the wing flexibility. From the results, it is noted that the chord-wise wing flexibility can produce a positive effect on flapping aerodynamic characteristics in quasi-steady and unsteady flow regions, thus the wing flexibility should be considered in a design for efficient flapping wings.

6423-021

Experimental investigation on electrorheological fluid rheology and dielectric properties

Y. Sun, M. Thomas, J. Masounave, École de technologie supérieure(Canada)

A new electrorheological (ER) fluid has been created with suspension-based powders dispersed in silicon oil, which called ETSERF. Because of the special structure of the particles, ETSERF suspensions present a complicated behavior: in the absence of an electric field, ETSERF suspensions show a near Newtonian behavior. When an electric field is applied, it exhibits a pseudoplastic behavior with yield stress. The ER effect under DC electric fields has been experimentally investigated by using both hydrous and anhydrous ER fluids. ER properties are strongly dependent on dielectric properties of ETSERF suspensions. Hydrous ER fluids have a high dielectric constant and a high relaxation frequency, which show a strong electrorheological effect. The relation between the electrorheological effect and the permittivity of ER fluids has also been extensively studied. Experimental results show that the interfacial polarization plays an important role in the electrorheological phenomenon. The aging of ETSERF fluids was studied. It was found that dielectric properties and ER properties are strongly related to the time of aging, mainly the dielectric lost factor is effects. A fresh ETSERF suspension exhibits a high relaxation frequency and a high dielectric constant. These results are mainly explained by the effect of the interfacial polarization.

6423-022

Residual vibration suppression of flexible manipulators using ER adaptive structures

Huanqing Tang, Kexiang Wei, Yingchun Liu, Hong You, Hunan Institute of Engineering(China)

With the demand of increased productivity and better manufacturing of goods, the robot arm is now required to operate at high speed with more precise positional accuracy. This requirement motivates the use of lightweight robot manipulators possessed of high payload/weight ratio, power-efficient, and light-weight configuration. However, the lightweight and highly flexible nature of these manipulators is more susceptible to bending deformation because high speed operation leads to high inertial forces, which in turn causes undesirable vibrations at the arm tip and decreases the positioning precision. In the past decades, there have been a number of research activities to control unwanted vibration of flexible manipulators. In this study, the electrorheological (ER) adaptive structures, which behave as viscoelastic damping structures with controllable shear modulus, are used to suppress the residual vibrations of flexible manipulators. An ER sandwich beam specimen, in which an ER fluids layer is sandwiched between two aluminium surface layers, is constructed. An experiment set-up is established to investigate the effect of the ER fluids on vibration suppression of the rotating ER beam with point-to-point motion. The vibration response performances of the beam subjected to different electric field intensity and motion conditions are demonstrated and evaluated. The experimental results obtained indicate that significant vibration attenuation is achieved at different operating conditions by applying an electric field to the rotating beam. These demonstrate the feasibility of ER fluids in attenuating the vibration of flexible manipulators.

6423-023

Properties of clutch using thixotropic MR fluid with surfactants

Shinzo Takata, Kenjiro Hosoo, Yoshimasa Inoue, Ryoichi Hanaoka, Tadashi Fukami, Kazuo Shima, Kanazawa Institute of Technology(Japan)

Properties of a magnetorheological (MR) clutch have been investigated by using newly developed suspensions consisting of carbonyl iron particles and thixotropic carrier fluid. The carrier fluid is composed of a rapeseed ester oil (vegetable oil) and synthetic smectite. The magnetic field dependences on an output torque of the clutch were examined under a fixed input torque for different densities of particles, surfactant or smectite in the suspensions. The thixotropic behaviors of the carrier fluid were evaluated using a rheometer of the coaxial cylinder type. The output torque increased with increases of the surfactant in the range 0 to 5 wt% for the MR fluid of 81 wt% particles with 7wt% smectite. On the other hand, the thixotropic effect was lost gradually with increase of the surfactant at the smectite concentration 7 wt%, but the output torque was increased with increasing the surfactant. In this case, the particles were easy to sediment because of a large different of density between the particles and the liquid. This sedimentation could be suppressed by the increase of the smectite concentration without decreasing of the torque.

6423-025

Development of smart composites for infrastructure applications

Kintak Lau, Limin Zhou, The Hong Kong Polytechnic University(China); Libo Yuan, Harbin Engineering

International Conference on Smart Materials *and* Nanotechnology in Engineering

1–4 July 2007

Harbin Institute of Technology, Harbin, P. R. China

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Welcome !

The organizing committee of the International Conference on Smart Materials and Nanotechnology welcomes you to this grand meeting. This unique conference offers many opportunities to communicate with colleagues from a variety of disciplines in universities, companies, factories, and governments from all over the world. As a premier event, this conference promises great excitement, inspiration and benefits. This conference, the first in what we hope will be a series that encompasses and bridges the rapidly evolving smart materials and the cutting edge nanotechnology for varied applications.

In the last decade, a wide range of novel smart materials have been produced for aerospace, transportation, telecommunications, and domestic applications. Meanwhile, nanotechnology is rapidly developed and it permits control of matter at the level of atoms and molecules which would form the building blocks of smart materials. Thus the combination of these two fields provides many advantages, realizes novel designs that could not be achieved in traditional engineering and offers greater opportunities as well as challenges.

The conference deals with the integration of smart materials and nanotechnology for applications ranging from bioengineering to photonics, with emphasis on the application in aerospace engineering. It also addresses and predicts novel developments in this field. It will discuss various topics including Shape-memory alloys and polymer, Electro-Active Polymer(EAP), Piezo-materials, Electro and magneto restrictive materials and fluids, Fibre optic sensor, MEMS sensors and actuators, thermo-electric materials, electro-chromic, photo-chromic and fluorescent and phosphorescent materials, nanocomposite and others.

There are 7 plenary speakers and 27 keynote speakers who were selected to inform and inspire the attendees. Roughly 290 papers, which are selected from about 700 papers will present in 35 Specialist sessions, 160 papers in General Sessions, and 130 papers in a Poster Session.

We would like to take this opportunity to thank the organizing committee, the cooperating organizations, the international scientific committee and every attendee, whose support, dedication, and cooperation make this event more exciting, inspiring and fruitful.

The organizing committee wishes that all participants enjoy the meeting and have a pleasant stay in Harbin! We hope all of you benefit from this conference and look forward to seeing you again in 2009!

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Tuesday 3 July

Session 16
Room A
Tues. 10:35 to 12:10am
Morphing and Biology-Inspired Structures
Chairs: Jae-Hung Han (Korea Advanced Institute of Science and Technology)
Willi E. Martin (EADS Corporate Research Centre)

10:35 to 11:00am: **Wind tunnel tests for a flapping wing model with changeable camber using macro-fiber composite actuators(Invited paper),** Jae-Hung Han[1], Dae-Kwan Kim[1], Ki-Jung Kwon[2], [1]*Korea Advanced Institute of Science and Technology (Republic of Korea),* [2]*Korea Aerospace Research Institute (Republic of Korea)*……..…….*6423-020*

11:00 to 11:25am: **Adaptive structures for fixed and rotary wing aircraft (Invited paper),** Willi E. Martin[1], Peter Jänker[1], Markus Siemetzki[1], Valentin Klöppel[2], Heinz Hansen[3], [1]*EADS Corporate Research Centre (Germany),*[2]*Eurocopter Germany (Germany),*[3]*Airbus Germany (Germany)*.……..…..*6423-084*

11:25 to 11:40am: I**nvestigation on adaptive wing structure base on shape memory polymer (SMP) composite hinge,** Yuemin Yu, Jinsong Leng, *Harbin Institute of Technology (China)* ….……..…….*6423-072*

11:40 to 11:55am: **Wing chamber control architectures based on SMA: numerical investigations**, Silvestro Barbarino[1], Salvatore Ameduri[2], Rosario Pecora[1], [1]*University. of Naples "Federico II" (Italy),* [2] *Italian Aerospace Research Centre (CIRA) (Italy)* ……..…..*6423-077*

11:55 to 12:10am: **The design of an SMA-driven flexible bionic fin with complex control surface**, Shiwu Zhang, Yonghua Zhang, Zhen Han, Qin Yan, Jie Yang, *University of Science and Technology of China (China).*…..…….*6423-071*

Session 17
Room B
Tues. 10:35 to 12:00am
Novel Sensors
Chairs: L Wang (University of Birmingham)
Shinn-Fwu Wang (Ching Yun University)

10:35 to 11:00am: **Self-sensing composites (Invited paper),** L Wang, S Malik, D Harris and G F Fernando, *University of Birmingham (UK)*……*6423-103*

11:00 to 11:15am: **The electric-field analyse and design of the sensor in international voltage transducer,** Weihong Bi, Feng Liu, Jian Wang, *Yanshan university (China)*……..*6423-110*

11:15 to 11:30am: **Optical fiber biosensor based on multiple total internal reflections in heterodyne interferometry,** Shinn-Fwu Wang, Jyh-Shyan Chiu, Ming-Jen Wang, *Ching Yun University (Taiwan, China)*…….…..*6423-114*

11:30 to 11:45am: **DNA electrochemical biosensor of methylene blue as the hybridization indicator,** Jimei Zhang[1], Wei Tong[2], Zhao Dai[1], Shichao Xu[1], Ning Guo[1], Xiang Wang[1], [1]*Tianjin Polytechnic University (China),* [2]*Tianjin Armed Forces Medical College (China).*……*6423-087*

11:45 to 12:00am: **PVA/PNIPA thermosensitive fibers,** Feng Xia, Chen Li, Leilei Ju, *Tianjin Polytechnic University (China)* …….. ……*6423-112*

Session 18
Room C
Tues. 10:35 to 12:00am
Magnetic Materials
Chairs: Limin Zhou **(**The Hong Kong Polytechnic University)
Chengbao Jiang(Beijing University of Aeronautics and Astronautics)

10:35 to 11:00am: **Magnetostriction of oriented and single crystals in Fe-Ga magnetostrictive alloys (Invited paper),** Chengbao Jiang, Jinghua Liu, Huibin Xu, *Beijing University of Aeronautics and Astronautics (China).*……..*6423-177*

11:00 to 11:15am: **Magnetization and magnetostriction ($Tb_{0.36}Dy_{0.64})_{1-x}Ho_xFe_{1.95}$ alloys,** Hongbo Zhang, Chengbao Jiang, Huibin Xu, *Beijing University of Aeronautics and Astronautics (China)*…….*6423-181*

11:15 to 11:30am: **Influence of ambient temperature and magnetic field on damping behavior of Fe-13Cr-2.5Mo alloy,** Yonggang Xu [1,2], Ning Li [2], Baoluo Shen[2], Hongxing Hua[1], [1]*Shanghai Jiao Tong University (China),* [2]*Sichuan University (China).*……..*6423-218*

11:30 to 11:45am: **Magnetostrictive Properties of Polymer-bonded Terfenol-D Composites,** C. Rodríguez[1], A. Barrio[2], I. Orue[2], J.L.Vilas[1], J.M. Barandiarán[2], M.L. Fdez –Gubieda[2], L.M. Leon[1]. Jose maria Cuevas, [1]*Departamento de Química Física,* [2]*Departamento de Electricidad, Universidad del País Vasco (Spain)* *6423-054*

11:45 to 12:00am: **Principle and Experiment Research of Magnetic-elastic Stress Sensor Based on Magneto-elastic Effect,** Jianshan Jiang[1,2], Shanglian.Huang[2], Weimin.Chen[2,] [1]*Chongqing Jiaotong University (China),* [2]*Education Ministry of China Chongqing University (China).....6423-178*