1

A compressible magneto-rheological fluid damper-liquid spring system [Texto impreso] / Mutyala Rao Potnuru, Xiaojie Wang, Sreeram Mantripragada, Faramarz Gordaninejad

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 274 : 14 refs.

In this study, a compressible magneto-rheological fluid damper-liquid spring (CMRFD-LS) system is designed, built and tested. The CMRFD-LS functions as a liquid spring and a controllable fluid damper in a single unit. The CMRFD-LS system has a Magneto-Rheolgical (MR) valve with tapered annular flow channel. The flow profile and pressure drops due to varying cross sections of the flow path under different applied magnetic fields are studied. To evaluate the spring effect, experiments are carried out using pure silicone oil under different input displacements and frequencies. The spring effect of the liquid spring and the energy dissipated due to damping are obtained from the performance tests conducted with MR fluid, which is composed of 80% (wt.) iron particles suspended in silicone oil. The equivalent spring coefficient, equivalent damping coefficients and energy dissipated for different sinusoidal input displacements at different motion frequencies and applied electric currents are determined from these force-displacement loops of experimental results. The effect of the tapered flow path on the pressure drops for compression and rebound is investigated.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 256-274

1. Compressible 2. MR fluid 3. Liquid spring 4. Semi-active damping

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2

A magnetorheological-elastomer-based energy absorption device for car crash protection [Texto impreso] / Lingyu Sun, Wei Li, Shirong Guo, Weiwei Chen

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 239-240 : 16 refs.

For ideal protection from various car collision scenarios, it is required that there be an energy absorption device that is able to adjust its stiffness and damping capacities according to the situation. A Magnetorheological Elastomer (MRE) Based Adaptive Energy Absorption Device (MREBEAD) is proposed and developed to take advantage of its controllable characteristics for car bumper systems. The distribution and amplitude of the magnetic flux density are verified by the finite element method. Both the shear and compression stiffness properties of MREs are derived analytically. In addition, a series of these devices are installed behind a car bumper and the dynamic response and energy storage of the bumper system are demonstrated through the MATLAB/Simulink software. The results show that the proposed MREBEAD system for car crash protection at low speed collisions is more effective than the traditional metal crash box in avoiding plastic deformation and decreasing damage to passengers and as a result, in reducing repair and medical costs.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 223-240

1. Magnetorheological elastomers 2. Adaptive energy storage 3. Car crash protection 4. Finite element method 5. Optimisation

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3

Analysis of a magnetorheological damper incorporating temperature dependence [Texto impreso] / Nicholas L. Wilson, Norman M. Wereley, Wei Hu, Gregory J. Hiemenz

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 155-157 : 39 refs.

Aside from external environmental heating, a magnetorheological (MR) damper may internally self-heat due to both resistive heating by the electromagnetic coil and to a greater extent, by dissipating mechanical energy into thermal energy. Temperature can significantly alter damper behaviour, as the fluid viscosity and accumulator gas pressure are highly dependent on temperature. Therefore, to improve the understanding of the behaviour of a linear stroke MR damper, a damper designed for a ground vehicle seat suspension, its performance is characterised over temperatures ranging from 0 to 100°C. A hydro-mechanical analysis is used to represent MR damper behaviour when it is subjected to large temperature perturbations and captures contributions from fluid viscosity, fluid inertia and pneumatic compressibility. The effect of damper self-heating on the identified model parameters is presented and the connection of these parameters to physical properties is also discussed.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 137-158

1. MR damper 2. Temperature 3. Fluid inertia 4. HSIC 5. Hydro-mechanical analysis

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4

Characterisation of friction reduction with tangential ultrasonic vibrations using a SDOF model [Texto impreso] / Shravan Bharadwaj, Marcelo J. Dapino

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 303-304 : 16 refs.

Active control of friction between sliding surfaces is of fundamental and practical interest in automotive applications. It has been shown that the friction force between sliding surfaces decreases when ultrasonic vibration is superimposed on the sliding motion. This principle can be applied to systems in which solid state lubrication or friction modulation is advantageous. The ultrasonic vibration may be applied longitudinally or normal to the direction of motion. A number of friction models have been considered in order to analyse this phenomenon. The degree of friction reduction has been shown to depend on the ratio of the sliding velocity to the vibration velocity. Since friction is a system response, it is necessary to include system dynamics in the analysis of ultrasonic lubrication. A nonlinear single-degree-of-freedom model is formulated and numerically approximated to quantify the effect on friction reduction of control force, intrinsic coefficient of friction, mass load, tangential contact stiffness at the sliding interface, and system stiffness. Model results are in close agreement with experimental measurements.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 291-304

1. Piezoelectric actuators 2. System dynamics 3. Ultrasonic lubrication 4. Vehicle design

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5

Design of car hood of sandwich structures for pedestrian safety [Texto impreso] / Tso-Liang Teng, Cho-Chung Liang, Chien-Jong Shih, Manh-Trung Nguyen

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 198 : 14 refs.

Vehicle safety factors should simultaneously consider occupant and pedestrian safety, given that pedestrians are the third largest category of traffic fatalities. Most pedestrian deaths occur due to traumatic brain injury, resulting from the hard impact of the human head against the vehicle's stiff hood or windshield. Therefore, how to design a pedestrian-friendly vehicle and propose a new hood structure is a matter of urgency for minimising pedestrian head injuries. In this study, three kinds of sandwich hood structures are proposed for reducing pedestrian head injuries, including carbon fibre-reinforced polycarbonate, carbon fibre-reinforced foam and aluminium-reinforced polycarbonate. In assessing the friendliness of vehicle hoods, this study adopts the EEVC/WG17 regulations on headforms for hood tests. The finite element method is used to simulate the impact between the vehicle's hood and the headform impactor. The software used in simulation is LS-DYNA. The results predicted by the headform-hood tests show that the hood structure with aluminium-reinforced polycarbonate material provides enough absorption capability to protect pedestrians from the impacts of accidents. It is also stiff enough to keep pedestrians' heads away from the inner parts of the engine cavity. The analysis models and sandwich materials proposed herein contribute to efforts to design vehicle hood structures and pave the way for developing pedestrian protection technologies.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 185-198

1. Pedestrian 2. Hood 3. Sandwich structures 4. Head injury 5. Headform 6. EEVC/WG17

6

Hydraulic hybrid vehicle vibration isolation control with magnetorheological fluid mounts [Texto impreso] / The Nguyen, Mohammad Elahinia, Shuo Wang

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 219-220 : 19 refs.

Hydraulic Hybrid Vehicle (HHV) is an emerging technology especially for heavy-duty vehicles, thanks to its high efficiency and power density. However, one of the main problems that should be solved to enable the successful commercialisation of HHV is the excessive noise and vibration involved with hydraulic systems. This study focuses on using the magnetorheological fluid (MRF) technology to reduce the noise and vibration transmissibility from the power sources to the vehicle body. To study the noise and vibration of HHVs, a HHV structure in parallel design was analysed. An MRF mount, to use for the engine and pump/motor, was designed, fabricated and tested. Vibration control schemes based on the skyhook algorithm were utilised to reduce the transmissibility and amplitudes of vibration. The research showed that the MRF mounts played an important role in reducing the noise and vibration transmitted to the vehicle body. Additionally, the locations and orientations of the isolation system affected the efficiency of the noise and vibration mitigation.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 199-222

1. Hybrid vehicle 2. Noise 3. Vibration 4. Magnetorheological 5. Engine mount 6. Pump 7. Motor 8. Hydraulic 9. Fuzzy logic 10. Hierarchical control

7

Magneto-rheological fluid flow through complex valve geometries [Texto impreso] / Huseyin Sahin, Xaiojie Wang, Faramarz Gordaninejad

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 254-255 : 19 refs.

In this study, the flow behaviour of Magneto-Rheological (MR) fluid through complex valve geometries is investigated using analytical, computational and experimental approaches. A two-dimensional MR valve model is constructed for computational simulation based on a unique MR device that has circular, radial and annular flow regions. When compared with analytical solutions, the results of the Computational Fluid Dynamics (CFD) model, which has taken into account minor losses of MR fluid flow in different valving areas, are in good agreement with those of experimental measurements. It has been shown that the Bingham CFD model works well for complex flow geometries in the two-dimensional domain and that the CFD method can be greatly beneficial in the design and development of MR devices for practical applications.

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1. MR fluids 2. Complex valves 3. CFD 4. Computational fluid dynamics

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Quasi-steady modelling for magneto-rheological fluid mount based on squeeze mode and experimental testing [Texto impreso] / Liao Chang-rong, Xie Lei, Zhao Dan-xia, Liu Qiong

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 289-290 : 16 refs.

A Magneto-rheological (MR) fluid mount based on parallel disk squeeze mode, is put forward to implement the controllable dissipation of vibration energy. An analytical quasi-steady modelling is proposed to simulate the MR fluid squeeze radial flow. Its differential equation is set and solved with the Navier slip boundary condition and the compatible condition. Both the MR fluid radial flow velocity profile and the radial pressure distribution are derived by using bi-viscous constitutive model. The interface between the Newtonian flow region and bi-viscous flow region is theoretically determined. An approximate arithmetic of the squeeze force is developed and its mathematical expression is obtained. Some influences of the slip coefficient and the radial coordinate on the radial flow velocity profile are examined. To verify the modelling, a corresponding MR fluid mount is designed and fabricated and tested on MTS870 Electro-hydraulic Servo using sine wave excitation (oscillation frequency 5 Hz, amplitude 1.0 mm, current from 0.0 to 2.0 A in increments of 0.2 A). The experimental result reveals that the analytical squeeze result is in good agreement with the experimental squeeze forces. The diagram of the analytical squeeze forces vs. disk displacement agrees mainly with that from the experimental testing.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 275-290

1. MR 2. Magneto-rheological fluid 3. Mount 4. Squeeze mode 5. Modelling 6. Squeeze force

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Semi-active control of an integrated full-car suspension with seat suspension and driver body model using ER dampers [Texto impreso] / Haiping Du, Weihua Li, Nong Zhang

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 182-184 : 35 refs.

In this paper, an integrated vehicle semi-active suspension control system that includes a full-car suspension model (7 Degree-Of-Freedom (DOF)), a seat suspension model (2 DOF) and a driver body model (4 DOF) is developed. A H∞ static output feedback controller which only uses measurable variables as feedback signals is designed to improve vehicle ride comfort performance in terms of driver head acceleration under constraints of actuator saturation, suspension deflection limitation and road holding capability. The controller design conditions, which are expressed as Linear Matrix Inequalities (LMIs) are derived by dealing with each control input separately under a common Lyapunov function, so that a feasible solution can be found for the integrated high order system that has five control inputs and ten control outputs; each control input may require different feedback signals and have different saturation limitations. Furthermore, a semiactive control strategy is applied to implement the proposed control system using electrorheological (ER) dampers. Numerical simulations are used to evaluate the improvement of ride comfort performance in terms of driver head acceleration responses under typical road disturbances.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 159-184

1. Integrated semi-active control 2. ER damper 3. Vehicle suspension 4. Seat suspension 5. Driver body model

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Semi-active control of magneto-rheological variable stiffness and damping seat suspension with human-body model [Texto impreso] / Xiao-min Dong

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 134-136 : 28 refs.

The potential benefits of an MR seat suspension in improving ride quality are investigated. Two magneto-rheological (MR) dampers are devised and manufactured to realise the variable damping and equivalent stiffness capacities of a seat suspension, respectively. After evaluating field-dependent damping characteristics of the MR seat damper, the equation of equivalent variable stiffness is also shown. A seat suspension model with a four-DOF human body model is then formulated. A Human Simulated Intelligent Controller (HSIC) is proposed to attenuate the unwanted vibration of the variable stiffness and damping seat suspension. To validate the control performance of the proposed seat suspension and the control scheme, a numerical simulation is performed under the bump, random and chirp excitations. The result indicates that the proposed seat suspension system with HSIC can significantly improve the driver's ride quality compared to the passive one.

International Journal of Vehicle Design. -- 2013, v. 63, n. 2-3, p. 119-136

1. MR damper 2. Magneto-rheological damper 3. Seat suspension 4. HSIC 5. Human simulated intelligent controller 6. Semi-active control 7. Passive control

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11

Stochastic modelling of 1-D and 2-D terrain profiles using a polynomial chaos approach [Texto impreso] / Lin Li, Corina Sandu

Este artículo se encuentra disponible en su edición impresa. Los datos para su localización están accesibles a través del enlace al título de la publicación.

References: p. 324-325 : 21 refs.

One fundamental difficulty in understanding the physics of vehicular off-road traction and in predicting vehicle performance is the variability of the terrain profile. These operating conditions are uniquely defined at a given spatial location and a given time. It is not practically feasible to measure them at a sufficiently large number of points to be able to accurately represent the terrain in models, or to use all the data collected to recreate the terrain profile. This renders traditional analysis tools insufficient when dealing with rough terrain. In this study, mathematical tools to quantify the impact of uncertainties in the terrain profile on vehicle mobility are developed. A polynomial chaos approach is used to reconstruct one-dimensional (along longitudinal direction) stationary and non-stationary terrain profiles. Also, an efficient mathematical method based on the Karhunen-Loeve expansion and the approach for 1-D stochastic terrain profile is developed to reconstruct two-dimensional (along longitudinal and lateral directions) terrain profiles. The proposed mathematical methods calculate the autocorrelation of terrain profiles, solve eigenvalues and eigenvectors of the autocorrelation function, and obtain the corresponding orthogonal random variables directly. The original terrain profile is reconstructed by Karhunen-Loeve expansions, requesting a small, limited computational effort, without the need to verify the terrain data for Gaussianity, stationary, and linearity, and without the need to choose the order of the expansion and the corresponding fitting coefficient artificially. Promising simulation results based on experimental data are obtained using the proposed methods. The schemes to choose the number of eigenvalues and eigenvectors are discussed. The proposed mathematical methods can be used to simulate the terrain profile for on-road and off-road vehicle dynamics or robotic applications.

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1. Stochastic terrain profile 2. Karhunen-Loeve expansion 3. Polynomial chaos 4. Stationary

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