1

Cyclic strain rate in tyres as power source to augment automobile autonomy [Texto impreso] / C. A. Varela, F. Z. Sierra

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. 284-285 : 25 refs.

The strain rate that takes place in the belts of tyres during automobile movement is proposed for converting mechanical energy into electricity. This paper describes how cyclic strain in tyres can be used for exciting piezoelectric materials placed in contact with the inner side of the tyre belt. Stress strain in tyre belts is caused by total mass weight in equilibrium with a pressurising condition. Under this condition, one section of the tyre in contact with the pavement deforms gradually until a maximum is reached, followed by a smooth release. The effect is continuous during each cycle of tyre rotation. Numerical simulations based on the finite element method were conducted for calculating the stress in composite materials that reproduce a combination of tyre belt piezoelectric polymer films. Results were obtained for different conditions of velocity and automobile total mass. The piezoelectric material was sectioned into elements that cover the entire belt interior, leading to continuous generation of electricity. The numerical simulations assumed that automobile speed varied from 0 to 113 km/hr, combined with mass increments from one to five passengers, for a constant inflation pressure. The results indicate that electric current generated by the strain-stress in tyres increases almost linearly as a function of weight and speed. The electricity generated in tyres can be used to recharge the batteries in hybrid and conventional cars. It can even lead to reductions of alternator capacity. This process is a function of travel distance as well, since harvesting of energy takes place every tyre cycle.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 270-285
1. Automobile power source 2. Cyclic strain 3. Piezoelectricity generation 4. Strain in tyres

---

2

Development and validation of a FE model of a mining vehicle tyre [Texto impreso] / Zhanbiao Li, Aleksander Tonkovich, Sante Dicecco, William Altenhof, Henry Hu, Richard Banting

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. 200-201 : 12 refs.

Due to the harsh operating conditions and high payload requirements of heavy mining vehicles, extremely durable, stiff and large, heavy sized tyres are necessary to meet functional requirements. This necessitates the use of multi-piece wheels to allow mounting of the tyre. As part of an on-going study to enhance the safety and design of multi-piece heavy mining vehicle wheels, finite element methods are applied to develop a tyre model of a bias-ply Goodyear 29.5-29 Smooth, D/L 5D (I-5S) 40 ply model used on a Caterpillar R2900G load-haul-dump (LHD) scoop. The model is validated based on manufacturer engineering data, static load testing and quasi-static testing. Tyre deformation was determined using non-contact displacement transducers and analysis of high speed imagery acquired during testing which was representative of harsh tyre loading. Development of an FE model of the wheel and tyre assembly model was completed and error estimates on the displacement measurements on several locations of the tyre, representing vertical, horizontal and out-of-plane deformations, were typically less than 10% when compared to experimental observations. Maximum values of the vertical and lateral deflections of the tyre in both experimental and numerical investigations, considering the most severe loading case within this investigation, were observed to be approximately 80 mm and 30 mm, respectively. This study details the methodology used in the development of a high fidelity numerical mining vehicle tyre model capable of simulating static and quasi-static loading conditions.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 176-201
1. Finite element analysis 2. Heavy mining vehicle 3. Tyre model validation 4. Tyre modelling 5. Wheel assembly modelling

3

Development of rational tyre models for vehicle dynamics control design and combined vehicle state-parameter estimation [Texto impreso]/ S. Çaglar Baslamisli

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. 173-175 : 32 refs.

In this paper, control oriented rational tyre models are developed and incorporated in the design of vehicle dynamics estimators and controllers. Previously proposed rational models are used to derive a generic rational tyre model whose parameters are obtained through the optimisation of an increased number of regression terms. The proposed model results in vehicle dynamic responses that closely follow those obtained with a Magic Formula tyre model for a range of driving scenarios, especially on low μ roads. The usage of rational tyre models in the design of a gain-scheduled active front steering controller working in coordination with a nonlinear observer is demonstrated in the second part of the paper where the vehicle model is expressed as a linear parameter varying system. This final step demonstrates the strength of the rational tyre models' selected structure allowing the estimation of vehicle states through the estimation of the road adhesion coefficient which is obtained by simple algebraic computations.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 144-175

1. Magic formula tyre model 2. Nonlinear observer 3. Rational tyre model 4. State/parameter estimation 5. Vehicle design 6. Vehicle dynamics control

---

4

Effects of pavement texture on pavement friction [Texto impreso]: a review / Chengyi Huang, Xin Huang

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. 267-269 : 56 refs.

Although the sliding friction of vehicle tyres was first studied a long time ago, some fundamental aspects of the interaction mechanism and phenomenon between pavement texture and tyre tread still remain unclear. At present, most of the theoretical functions used to predict the interaction are based on experimental regressive analysis. Therefore, understanding of the interaction mechanism is rather limited. On the other hand, traffic accidents are serious problems that cause the loss of both life and property. Some fatal accidents were found to result from deficiency in pavement friction. Thus, a review and summary of the present research works relevant to pavement texture and pavement friction are provided and some future research work is discussed.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 256-269

1. Adhesives 2. Hysteresis 3. Pavements 4. Skid resistance 5. Surface roughness

5

An intelligent tyre based adaptive vehicle stability controller [Texto impreso] / Mustafa Ali Arat, Kanwar B. Singh, Saied Taheri

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. 142-143 : 29 refs.

Active safety systems have become an essential part of today"s vehicles. Although they have advanced in many aspects, there are still many areas where that they can be improved. Being able to obtain information about tyre-road conditions (e.g., slip ratio, tyre-slip angle, tyre forces, tyre-road friction) would be especially significant due to the key role tyres play in providing directional stability and control. Current systems are capable of obtaining such information by means of indirect methods (i.e., vehicle kinematic relations); however, they tend to fail in severe manoeuvres mainly because of the highly nonlinear characteristics of tyres. As a result, other methods are sought to directly obtain information about tyre-road interaction. This paper examines such a method where a tyre-attached sensor unit (intelligent tyre system) provides tyre slip information and the potential performance improvements offered by integrating this system with an adaptive vehicle stability controller.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 118-143

1. Intelligent tyre 2. Sliding mode observer 3. Lyapunov stability 4. Integrated chassis control 5. Adaptive vehicle stability 6. Vehicle design

---

6

A new empirical 'exponential' tyre model [Texto impreso] / Matthew C. Best

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 : 12 refs.

In this paper, a new and simple formula is presented for empirical modelling of tyre force data. Based on exponential functions, it is capable of matching single slip data for lateral or longitudinal forces using three parameters, which can be computed in terms of stiffness, peak and saturated force values. Through a factorial study, the three parameters are also reformulated into functions of load and slip to provide full mapping of Fx and Fy across the range of longitudinal slip, lateral slip and vertical load. Significantly, the resulting model does not rely on a total slip calculation, so it retains a simple structure in force vs. slip or load derivatives. The new model is compared with two alternative simple tyre models and is shown to map forces generated from a reference Pacejka model. It is also used to fit measured tyre force data accurately.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 241-255

1. Empirical model 2. Tyre model 3. Vehicle dynamics 4. Vehicle control

7

A ride comfort tyre model for off-highway vehicles [Texto impreso] / Thomas H. Langer, Thorkil K. Iversen, Ole Ø. Mouritsen, Morten K. Bak, Michael R. Hansen

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 : 25 refs.

Tyre modelling is a major challenge when using time domain multibody simulation models to evaluate ride comfort on off-highway commercial vehicles. Further, parameters for these big tyres are difficult to obtain and thus, commercial car tyre models are difficult to apply. In this research work, a simple vertical tyre model for off-highway ride comfort evaluation is suggested. A displaced volume approach has been developed and combined with the slip theory to yield a tyre model that can be characterised by only three parameters. Full scale measurements on a dump truck have been carried out. Force responses from measurements are compared to the simulation results. Acceleration responses and the level of wholebody vibrations have also been compared.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 222-240

1. Multibody dynamics simulation 2. Off-highway 3. Ride comfort 4. Tyre modelling 5. Vehicle design 6. Vehicle dynamics 7. Whole-body vibration

---

8

Tyre-road interaction model for the prediction of road texture influence on rolling resistance [Texto impreso] / Stijn Boere, Ines Lopez Arteaga, Ard Kuijpers, Henk Nijmeijer

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. 220-221 : 29 refs.

A novel modelling approach to predict the influence of road texture on the rolling resistance of car tyres is presented where the large static tyre deformations and the small texture induced tyre vibrations are treated separately. The energy dissipation due to the large continuous cyclic deformation of the tyre cross section for a treadless tyre subject to nominal load on a smooth road is determined in a non-linear steady-state rolling analysis on an FEM tyre model. The additional energy dissipation resulting from the contact forces and tyre vibrations due to the combined effect of the tread profile and the road texture, are determined based on a modal representation of the deformed tyre. The predicted rolling resistance coefficients are compared to experimental data. Although an offset in the absolute rolling resistance levels can be observed, the model predicts the correct trend regarding the increase of rolling resistance with increasing texture depth.

International Journal of Vehicle Design. -- 2014, v. 65, n. 2-3, p. 202-221

1. Interaction 2. Resistance 3. Road 4. Rolling 5. Texture 6. Tyre 7. Vibration