1

A saturation-balancing control method for enhancing dynamic vehicle stability [Texto impreso] / Justin Sill, and Beshah Ayalew

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. 64-65 : 31 refs.

This paper proposes a vehicle stability control method that quantifies and uses the level of lateral force saturation on each axle of a vehicle. The magnitude of the saturation is determined from on-line estimated nonlinear lateral tyre forces and their linear projections. Once known, saturation levels are employed in a saturation balancing control structure that biases the drive torque to either the front or rear axles/wheels. The control structure avoids the need for an explicit reference model to generate target responses. The benefits of the proposed approach are demonstrated considering a nominally unstable vehicle in an extreme obstacle avoidance manoeuvre.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 47-66

1. VSC 2. Vehicle stability control 3. Saturation balancing 4. Tyre force estimation 5. Axle saturation level 6. Independent drive 7. Torque biasing

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2

An efficient optimal design methodology for non-linear multibody dynamics systems with application to vehicle occupant restraint systems [Texto impreso] / Guang Dong ... [et al.]

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. 202-203 : 18 refs.

The need exists for robust and efficient optimal design methods for application to multibody systems, in which the components to be designed represent connections between large displacement, large rotation motions of the subsystems' bodies. One specific application is occupant restraint systems, such as the Gunner Restraint System (GRS), in which both the vehicle and the gunner can undergo large relative and absolute motions under extreme driving or external threat conditions. In addition, the restraint/connection components can have amplitude-dependent, time-dependent, and timing-dependent behaviour, such as an active belt retractor. Current optimisation methodologies are ill suited for this problem, suffering from infeasibility, lack of robustness, and/or high computational expense. This paper presents an extension of topology optimisation techniques to consider multibody dynamics systems and to treat a much more open design space, which can include passive, active, and reactive structures/devices. The objective is to obtain an optimally combined structural and material system, considering the best use of passive, active and reactive members.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 177-203

1. Active devices 2. Automotive vehicles 3. Multibody dynamics 4. Topology optimisation 5. Restraint system 6. Sensitivity analysis 7. Vehicle safety

3

An efficient re-analysis methodology for vibration of large-scale structures [Texto impreso] / Zissimos P. Mourelatos, Efstratios Nikolaidis

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. 106-107 : 21 refs.

The Finite Element Analysis (FEA) is a well-established methodology in structural dynamics. However, optimisation or probabilistic studies can be prohibitively expensive, because they require repeated FEA of large models. Various re-analysis methods have been proposed in order to calculate efficiently the dynamic response of a structure after a baseline design has been modified, without recalculating the new response. Although these methods are promising by themselves, they cannot handle large FE models with large numbers of Degrees of Freedom (DOF) (e.g., 100,000) and design parameters (e.g., 50), which are common in practice. In this paper, a new re-analysis method is proposed to address these shortcomings. A simple frame structure is used to explain all steps of the proposed method. Also, a vibro-acoustic analysis of a realistic vehicle FE model is presented to demonstrate the efficiency and accuracy of the new method. A design optimisation study is also performed to highlight the accuracy and efficiency of the proposed re-analysis method.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 86-107

1. Efficient re-analysis 2. Finite elements 3. Vibroacoustic response 4. Design optimisation

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4

Battery power management in heavy-duty HEVs based on the estimated critical surface charge [Texto impreso] / Tae-Kyung Lee, Youngki Kim, Denise M. Rizzo, Zoran S. Filipi

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. 126-127 : 23 refs.

This paper proposes a battery power management strategy using Critical Surface Charge (CSC) information estimated by Extended Kalman Filter (EKF) in real time. The insight from CSC characterisation is used to propose a novel approach for supervisory control design of a series Hybrid Electric Vehicle (HEV). The underlying phenomenon determining the battery allowable power limits is closely connected to the CSC. The estimated CSC is processed with a Finite Impulse Response (FIR) filter to smoothen short-term fluctuations and highlight longer-term trajectories. The battery allowable power limits are adjusted based on the filtered CSC information to prevent undesirable battery operations.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 108-127

1. Lithium-ion battery 2. Power management 3. CSC 4. Critical surface charge 5. Lithium-ion concentration 6. Estimation 7. EKF 8. Extended Kalman filter 9. HEV 10. Hybrid electric vehicle

5

Development of a blast event simulation process for multi-scale modelling of composite armour for lightweight vehicles [Texto impreso] / John P. Kim, Nickolas Vlahopoulos, Geng 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. 175-176 : 26 refs.

This paper presents the development of a multi-scale simulation process for modelling the response of a vehicle with composite armour to the blast loads from an explosive threat. The new process can be used for improving the blast resistant capabilities of the composite armour by configuring its properties at the micro-level. A Blast Event Simulation sysTem (BEST), for conducting a complete sequence of explosive simulations, comprises one of the two main foundation components of the new development. The Micromechanics Analysis Code (MAC) comprises the second main foundation component. The development of the new multi-scale simulation capability and an associated case study are presented.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 157-176

1. Lightweight vehicles 2. Survivability 3. Blast event simulation system 4. Anthropometric test device 5. Multi-scale modelling 6. Composites 7. Matrix-fibre configuration

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6

Effect of coupling point selection on distortion in internet-distributed hardware-in-the-loop simulation [Texto impreso] / Tulga Ersal ... [et al.]

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. 82-85 : 45 refs.

The degree to which an Internet-Distributed Hardware-In-the-Loop (ID-HIL) simulation loses fidelity relative to the single-location alternative is referred to as distortion. This paper shows that, besides delay, the choice of coupling point, i.e., the port at which the system model is integrated across the Internet, also affects distortion. To quantify distortion, a frequency-domain metric is proposed using a linear systems framework. This metric is then used to analyse how the choice of coupling point affects distortion, leading to guidelines for selecting a coupling point that gives minimal distortion. The theory is demonstrated on a quarter-car model.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 67-85

1. Coupling points 2. Internet-distributed hardware-in-the-loop simulation 3. ID-HILS 4. Delay systems 5. Distortion

7

Magnetic and thermal scaling of electric machines [Texto impreso] / Jason Pries, Heath Hofmann

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. 232 : 5 refs.

In this paper, we will investigate performance relationships between electric machines whose dimensions are related by a uniform scaling factor. It is shown, assuming that the voltages applied to the scaled machine windings possess the same magnitude as those applied to the original 'unit' machine, that a corresponding scaling of the time domain ensures the magnetic fields in the machine are consistent with the original, unscaled machine. Furthermore, under the assumption of linear thermal conduction within the machine materials, it is shown that the temperature profile is consistent as well, provided the scaled cooling system can maintain the same temperatures at the machine's boundaries. This serendipitous result allows for straightforward scaling of machine performance characteristics, such as torque-speed curves and efficiency maps, which may be particularly useful for variable-speed and automotive applications.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 219-232

1. Scaling 2. Electric machines 3. Vehicle design optimisation 4. Numerically efficient analysis

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8

Multidisciplinary design optimisation under uncertainty: an information model approach [Texto impreso] / James A. Reneke ... [et al.]

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. 281-284 : 55 refs.

The design of a multi-purpose vehicle capable of performing diverse missions in diverse environmental conditions requires a multi-disciplinary approach. Uncertain missions implied by a multi-purpose design goal and uncertain environmental conditions resulting from multiple operating theatres involve tradeoffs in vehicle performance. An information model approach to handling tradeoffs is presented. The design process is conceptualized as proceeding in stages. At each stage, the design problem is decomposed from the top down into design levels and interacting components having uncertain elements on each level. The components may require different knowledge bases and models with different mathematical structures, time and size scales, calling for higher-level coordination. Component performances are modelled as random functions of uncertainties considered as deterministic variables. Information models are developed making use of second-order statistics of the random performance functions and an algebra of their reduced-order representations. Decision-making proceeds from the bottom up. Higher-level design decisions, the result of tradeoffs between alternative component designs, are based on the information models of the component performance functions. Preferred overall designs are determined within a finite set of feasible designs by means of multi-criteria optimisation methods without using mathematical programming. The methodology is illustrated by a simplified two-component vehicle design problem.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 249-284

1. Multidisciplinary optimisation 2. Engineering design 3. Decomposition 4. Information models 5. Reproducing kernel Hilbert spaces 6. Separable random fields 7. Second-order statistics 8. Reduced-order representations

9

Parametrisation and estimation of surrogate critical surface concentration in lithium-ion batteries [Texto impreso] / C. Speltino, A.G. Stefanopoulou, G. Fiengo

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. 154-156 : 30 refs.

In this paper a surrogate electrochemical lithium-ion battery model, presented and discussed in Di Domenico et al. (2008a) and Di Domenico et al. (2008b), is parametrised and validated through experimental data by a 10 cell 37 V 6.8 Ah Li-ion battery pack. Following past results (Zhang et al., 2000; Smith, 2010), the model is based on an approximate relationship between the electrode-averaged Butler-Volmer current and the solid-electrolyte interface concentration of a surrogate single particle for each cell electrode. Equally-spaced radially-discretised diffusion dynamics of the surrogate single particle for the positive electrode are then used to emulate the lithium concentration evolution in the cell. The surface concentration of the surrogate single particle, defined as surrogate Critical Surface Concentration (sCSC) is then used to predict the cell terminal voltage. The resulting model is as compact as an equivalent-circuit model but its underpinnings are lumped lithium-ion diffusion dynamics. A few parameters of the lumped lithium concentration dynamics are tuned using an iterative optimisation procedure with continuous and pulsed current profiles. The single particle lithium concentration profile and the surface concentration are then estimated using a 4th order Extended Kalman Filter (EKF) and the voltage predictions are compared with data.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 128-156

1. Lithium-ion battery 2. State of charge 3. Kalman filter

10

Quantification of the design relationship between ground vehicle weight and occupant safety under blast loading [Texto impreso] / Steven Hoffenson, Sudhakar Arepally, Michael Kokkolaras, Panos Y. Papalambros

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. 217-218 : 20 refs.

Military ground vehicle design must consider the threat posed by underbody blasts to new vehicles and their occupants, while also accounting for weight reduction goals for improving fuel economy and mobility. A two-stage process is presented to model the blast event, using LS-DYNA for simulating vehicle response and MADYMO for the occupant's response. Issues including computational expense, objective function formulation and multi-objective seating system design optimisation are addressed in detail, and three different blastworthiness optimisation formulations are presented and evaluated.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 204-218

1. Military ground vehicle design 2. Occupant safety 3. Blastworthiness 4. Vertical drop tower 5. Design optimisation

11

Robust signal processing for damaged vehicles with variability [Texto impreso] / Sung-Kwon Hong, Bogdan I. Epureanu, Matthew P. Castanier

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. 45-46 : 23 refs.

The focus of this paper is on establishing a robust signal processing approach for damaged vehicles (i.e., cracked structures) with structural variability such as thicknesses of various components and Young's modulus variations. The approach assumes that vibration-type data is collected during the operation of a vehicle. Next, the collected data is used in a novel combined sensor selection and signal processing methodology. The new methodology resolves two key issues for complex structures with variability: (i) decides which field data channels are statistically optimal to be used, and (ii) establishes which data channels should correlate and how. The overall algorithm is based on a generalised version of the effective independence distribution vector. Also, the correlations among channels are used for noise rejection. Furthermore, the dynamics of the vehicle (i.e., a complex structure with variabilities) is modelled using Parametric Reduced Order Models (PROMs) and the concept of bilinear mode shapes introduced recently by the authors for cracked structures. PROMs are used to address the presence of variability and account for their effects on the data collected from various channels. The bilinear modes are used to capture the effects of the crack. The proposed methodology is demonstrated for a complex/realistic model of a HMMWV frame with parameter variability and a crack.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 27-46

1. Robust signal processing 2. Variabilities 3. PROMs 4. Parametric reduced order models 5. Effective independence distribution vector 6. Bilinear mode shapes

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12

State-of-the-art of terrain profile characterisation models [Texto impreso] / Rui Ma, Heather Chemistruck, John B. Ferris

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. 301-304 : 54 refs.

In the automotive industry, proper mathematical models of terrain profiles provide a compact representation of excitations to vehicle simulations. Vehicle design is aided by accurately representing the excitation and thereby improving the accuracy of the resulting suspension loading conditions, vehicle response and fatigue life predictions. Terrain data acquisition methods are reviewed to provide a framework for the scope of applicability of these models. Several roughness indices are reviewed that identify and classify the type and general severity of terrain, including their measurement procedures, algorithms, applicability and limitations are discussed and compared. The statistical properties of the terrain and various modelling methods are reviewed, including Power Spectral Density (PSD), Markov Chains, Autoregressive Models, Wavelets and Hilbert-Huang Transformation (HHT). The advantages and disadvantages of these models are discussed based on the model's capability to capture the stochastic nature of terrain profiles. As a result of this review, the implications of the selection of a particular terrain model can be evaluated with respect to particular applications.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 285-304

1. Terrain data acquisition 2. Roughness indices 3. Terrain modelling

13

Towards a comprehensive framework for simulation-based design validation of vehicle systems [Texto impreso] / M. Kokkolaras ... [et al.]

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. 247-248 : 25 refs.

We present an overview of our most recent and ongoing research efforts to develop a comprehensive framework for simulation-based design validation of vehicle systems. Specifically, we present the three major building blocks of our framework: (1) the introduction of an appropriate validation metric for dealing with the multivariate functional data that are the output of dynamic vehicle systems; (2) the robust implementation of a Bayesian interval-based hypothesis testing technique for quantifying the confidence in simulation models used for design under uncertainty; (3) the development of a sequential design optimisation and calibration-based validation methodology that addresses the inadequacy of current validation practices in simulation-based design optimisation. We present a simple yet illustrative example and discuss the techniques being developed currently that will complete the proposed framework.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 233-248

1. Simulation 2. Dynamic systems 3. Validation metrics 4. Probabilistic principal component analysis 5. Bayesian interval-based hypothesis testing 6. Confidence quantification 7. Sequential design optimisation 8. Calibration based validation

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14

Vehicle sprung mass estimation for rough terrain [Texto impreso] / Benjamin Pence ... [et al.]

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. 25-26 : 30 refs.

This paper provides methods and experimental results for recursively estimating the sprung mass of a vehicle driving on rough terrain. A base-excitation model of verticla ride dynamics treats the unsprung vertical accelerations, instead of the terrain profile, as the input to ride dynamics. Recently developed methods based on polynomial chaos and maximun likelihood theory estimate the most likely value of the vehicle sprung mass. The polynomial chaos estimator is compared to least squares and Kalman filtering approaches. An experimental study suggests that the proposed approach provides accurate outputs and its less sensitive to tuning parameters than the benchmark algorithms.

International Journal of Vehicle Design. -- 2013, v. 61, n. 1-4, p. 3-26

1. Vehicle mass estimation 2. Rough terrain 3. Maximun likelihood estimation 4. Extended Kalman filtering 5. Polynomial chaos 6. Vehicle design