VEHICLE PERFORMANCE ANALYSER

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LITERATURE SURVEY

1. Vehicle Planar Motion Stability Study for TyresWorking in Extremely Nonlinear Region

Many researches on vehicle planar motion stability focus on two degrees of freedom(2DOF) vehicle model, and only the lateral velocity (or side slip angle) and yaw rate are considered as the state variables. The stability analysis methods, such as phase plane analysis, equilibriums analysis and bifurcation analysis, are all used todraw many classical conclusions. The fundamental assumption of the 2DOF model is that the longitudinal velocity is treated as a constant, but this is intrinsically incorrect. When tyres work in extremely nonlinear region, the coupling between the vehicle longitudinal and lateral motion becomessignificant extremely nonlinear region is investigated. Through the comparisons of the 2DOF and 3DOF models, it is discovered that the vehicle longitudinal velocity greatly affects the vehicle planar motion, and the vehicle dynamics represented in phase space portrait are fundamentally different from that of the 2DOF model.

2. Modelling and performance analysis of a vehiclewith kinetic dynamic suspension system

This paper presents a kinetic dynamic suspension (KDS) system to achieve enhanced cooperative control of the roll andwarp motion modes for on-road and off-road sports utility vehicles (SUV). The proposed KDS system consists of two hydraulic circuits acting on two pairs of torsional rods and levers, which can be treated as novel anti-roll bars. Hence, these anti-roll bars do not work independently, but are coupled to merely respond to particular motion modes. To verify the handling and ride performance of the system, a 14- DOF model of a SUV and a "magic formula" tire model are developed. The dynamic responses of the vehicle model with KDS suspension are obtained through half-sine bump, asynchronous sine road, and fishhook manual simulations.

The responses of the KDS equipped vehicle are compared to those of one with anti-roll bars to demonstrate its improved performance and also illustrate the side-effects. The results show that the KDS system considerably improves the vehicle's anti-roll ability.

3. Battery Performance Analysis for Working Vehicle Applications

The attention is focused on a specific battery testing methodology for high-power hybrid electric working vehicle applications. Due to the power demand, a deep knowledge of the battery behaviour is necessary and requires specific testing procedures, different from the standard activities available in the literature for the automotive field. In this article, the attention focused on the power demand that an energy storage system must satisfy to achieve a certain performance, considering this testing approach closer to the real application. A numerical model of a full electric telescopic handler developed in previous works was used to test a LiFePO4 cell in a hardware-in-the-loop bench test configuration. The output voltage–current characteristic was compared with the same output generated by the numerical model of the considered battery. The same model was then tested according to a handling working cycle proposed by the authors for a telescopic handler derived from the experience of the researchgroup in the field of this type of vehicles. This mission profilewas then used to evaluate the performance of the proposed battery pack configuration in a real working scenario and at different SoC levels.

4. **Improved vehicle performance using combined suspension and braking forces**

This paper investigates the integration of various subsystems of an automobile's chassis. The specific focus of this researchis the integration of active suspension components with anti- lock braking (ABS) mechanisms. The performance objective for the integrated approach is defined as a reduction in braking distance over just anti-lock brakes. A two degree of freedom half car vehicle model is developed along with models for a hydraulic active suspension and an ABS system. For both subsystems, actuator dynamics are included.

Individual controllers are developed for the subsystems and a governing algorithm is constructed to coordinate the two controllers. Simulations of the integrated controller and an ABS system demonstrate a significant increase in performance.

5. Physical modelling of tire wear for the analysis of the influence of thermal and frictional effects on vehicle performance

The tire and vehicle setup definition, able to optimise grip performance and thermal working conditions, can make the real difference as for motorsport racing teams, used to deal with relevant wear and degradation phenomena, as for tire makers, requesting for design solutions aimed to obtain enduring and stable tread characteristics, as finally for the development of safety systems, conceived in order to maximise road friction, both for worn and unworn tires. The physical modelling of complex tire–road interaction phenomena and the employment of specific simulation tools developed by the Vehicle Dynamics Uni Na research group allow to predict the tire temperature local distribution by means of TRT model and the adhesive and hysteretic components of friction, thanks to Gr ETA model. The cooperation between the cited instruments enables the user to study the modifications that a reduced tread thickness, and consequently a decreased SEL and dissipative tread volume, cause on the overall vehicle dynamic performance.

6. The effect of driving style on electric vehicleperformance, economy and perception

It has long been known that driving style has a major impact on the efficiency of conventional combustion engine powered vehicles. Particular aspects of conventional driving such as harsh acceleration and deceleration and poor anticipation have been demonstrated to be unfavourable for clear technical reasons relating to the efficiency of the internal combustion engine at particular speeds and loads. Furthermore, definite trends have been identified in terms of the relationship between age and drivingstyle for conventional vehicles. Little work has been done in this area using electric vehicles. We also look at how the drivers perceived the electric vehicle compared to conventional vehicles of the same class.

7. The Effect of Spot Weld Failure on Dynamic Vehicle Performance

Spot welds are the dominant joining method in the automotive assembly process. As the automated assembly process is not perfect, some spot welds may be absent when the vehicle leaves the assembly line. Furthermore, spot welds are highly susceptible to fatigue, so that a substantial number may fail during the vehicle lifetime. The scope of this article is two- fold. First, the impact of spot weld quality and design on a vehicle's functional performance is reviewed, addressing strength and stiffness, NVH and durability. The overview briefly covers both experimental tests and predictive finite element (FE) modeling approaches, explains the complexity of a spot weld design problem, and discusses optimization strategies. Second, an industrial robustness study is presented,that assesses the effect of spot weld failure on dynamic vehicle characteristics. Damaged models are generated automatically, by breaking a subset of the vehicle's spot welds, using a weighted-uniform selection probability. Monte Carlo simulations are then used to assess the scatter ondynamic vehicle characteristics.

8. Modelling community-scale renewable energy and electric vehicle management for cold-climate regions.

With increasing environmental problems of fossil fuel-based devices and systems in societies, diffusion and adoption of sustainability solutions such as renewable energy technologies and hybrid/electric vehicles have increased in the residential and commercial sectors. However, energy demand in the buildings and energy supply from renewables are complex, dynamic, and non-linear. This complexity shows itself in cold-climate regions that the supply of required energy from renewables is along with uncertainties and even sometimes stochastic. This paper assesses the energy supply/demand performance of a group of residential buildings in a community in a cold-climate region, St. Albert, Canada. First,all the buildings of the community are modelled and the required energy to respond to the demand and electric vehicles are calculated. Then, the potential of each building for electricity supply via photovoltaic panels is calculated.

Finally, the energy supply/demand management of the community is assessed using a machine learning tool.

9. Performance of Motor Vehicle based on Driving andVehicle Data

With the increasing population demographics and the dependency of man on motor vehicles as the primary source of transportation, the number of motor vehicles being registered for commercial as well as non-commercial activities on a daily basis is massive and yet continues to increase at an alarming rate. This has a direct and an unambiguous effect on the amount of fossil fuels being utilized globally and its subsequent environmental effects, which is of great concern in the present situation. Several attempts from various research sectors are ongoing in order toovercome this global issue and promising results are expected. This project is one such attempt at identifying the performance of small passenger cars in terms of fuel efficiency and map them with factors affecting it using machine learning techniques. The commencing activity while carrying out any such research activity will be the identification of the problem and all its possible sources. In this case, two potential sources can be identified and they are; the vehicle characteristics and the driver/driving behaviour.

10. Effects of Electric Vehicle Fast Charging on BatteryLife and Vehicle Performance.

As part of the U.S. Department of Energy's Advanced Vehicle Testing Activity, four new 2012 Nissan Leaf battery electric vehicles were instrumented with data loggers and operated over a fixed on-road test cycle. Each vehicle was operated over the test route, and charged twice daily. Two vehicles were charged exclusively by AC level two electric vehicle supply equipment, while two were exclusively DC fast charged with a 50 KW fast charger. The vehicles were performance tested on a closed test track when new, and after accumulation of 50,000 miles. The traction battery packs wereremoved and laboratory tested when the vehicles were new, and at 10,000-mile intervals throughout on-road mile accumulation. Battery tests performed include constant- current discharge capacity, electric vehicle pulse power characterization test, and low peak power tests. The data collected over 50,000 miles of driving, charging, andrest are analysed, including the resulting thermal conditions and power and cycle demands placed upon the battery. Battery performance metrics including capacity, internal resistance, and power capability obtained from laboratory testing throughout the test program are analysed. Results are compared within and between the two groups of vehicles overthe test period.