VDG representatives at ASME conference in Chicago

Three representatives of the Vehicle Dynamics Group (VDG) of the University of Pretoria travelled to the USA to present papers at the ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference held in Chicago, Il, USA from 12 - 15 August 2012.

Dr Cor-Jacques Kat (Lecturer) presented the paper entitled "**Computational efficiency and accuracy comparison of leaf spring modelling techniques**" at the 14th International Conference on Advanced Vehicle Technologies (AVT). His co-authors Dr Jennifer Johrendt and Prof Schalk Els are associated with the department Mechanical, Automotive and Materials Engineering at the University of Windsor in Ontario, Canada and the department of Mechanical and Aeronautical Engineering at the University of Pretoria. The abstract of the paper is given below with the full paper available in the proceedings of the conference.

Abstract:
Various methods exist to model leaf springs with each method having different advantages and disadvantages. Computational efficiency and accuracy are two important factors when choosing a modeling technique especially when the simulation models become large. This paper compares the computational efficiency and accuracy of an elasto-plastic leaf spring model to a neural network leaf spring model. The advantages and disadvantages of the two modeling techniques are discussed and suggestions are made for the best use of both models. It is also shown that combining the two methods can overcome some of the disadvantages and exploit the advantages of both methods. The results from the comparison quantify the accuracy and computational efficiency of the two methods giving concrete parameters for the analyst to decide on which model to use.

Mr Theunis Botha (PhD Student) presented a paper, co-authored by Prof Schalk Els, entitled "**Vehicle Sideslip Estimation Using Unscented Kalman Filter, AHRS and GPS**" at the 14th International Conference on Advanced Vehicle Technologies (AVT). His co-author is Prof Schalk Els. The abstract is given below and the full paper is available in the proceedings of the conference.

Abstract:
A vehicle's sideslip angle is an important parameter for both vehicle control and tyre property estimation. This paper details the method of determining a vehicles sideslip angle using an Attitude Heading Reference System (AHRS) and a Global Position System (GPS) in conjunction with the Unscented Kalman Filter (UKF). The addition of a single GPS antenna and the AHRS provides the ability to directly estimate the sideslip angle. Incorporating this direct measurement, as well as the summation of the gravity and gyro-compensated lateral acceleration to provide lateral velocity, allows the continuous and drift free estimation of the sideslip angle. The method is evaluated in simulation, using a validated non-linear full vehicle ADAMS model with added sensor noise. The estimated sideslip angle compares well against the simulated vehicle's sideslip angle.

Ms Anria Strydom (Masters student) presented a paper, co-authored by Prof Schalk Els, entitled "**Magneto-rheological (MR) damper modelling for semi-active control without force feedback**" at the 24th Conference on Mechanical Vibration and Noise (VIB). The abstract is given below and the full paper is available in the proceedings of the conference.

Abstract:

Ride comfort and handling characteristics are two important aspects of vehicle dynamics that generally require contrasting suspension settings. Different damper settings of the suspension system are required in order to meet these conflicting requirements. A magneto-rheological (MR) damper allows variable suspension settings to achieve enhanced ride comfort as well as handling characteristics by providing adaptable damping. Implementation of semi-active control requires an accurate MR damper model and online identification of model parameters. However, modeling a MR damper for a wide range of input conditions is challenging, especially when there are constraints on necessary measurements that are required for modeling. Although the available literature proposes various parametric models, many of these models are computationally expensive and are not viable for online identification. This paper presents a non-parametric model as well as a recursive model to predict the damping force of a MR damper in order to implement a semi-active control algorithm on an off-road vehicle. The results of the two models are compared to a conventional parametric model. The recursive model is used to demonstrate the significance of including the measured damping force in the model. Whereas the availability of the measured damping force yields a reasonably accurate model, the lack of measured damping force significantly impairs the recursive model.

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Dr Cor-Jacques Kat (Left), Mr Theunis Botha (Middle) and Ms Anria Strydom (Right)