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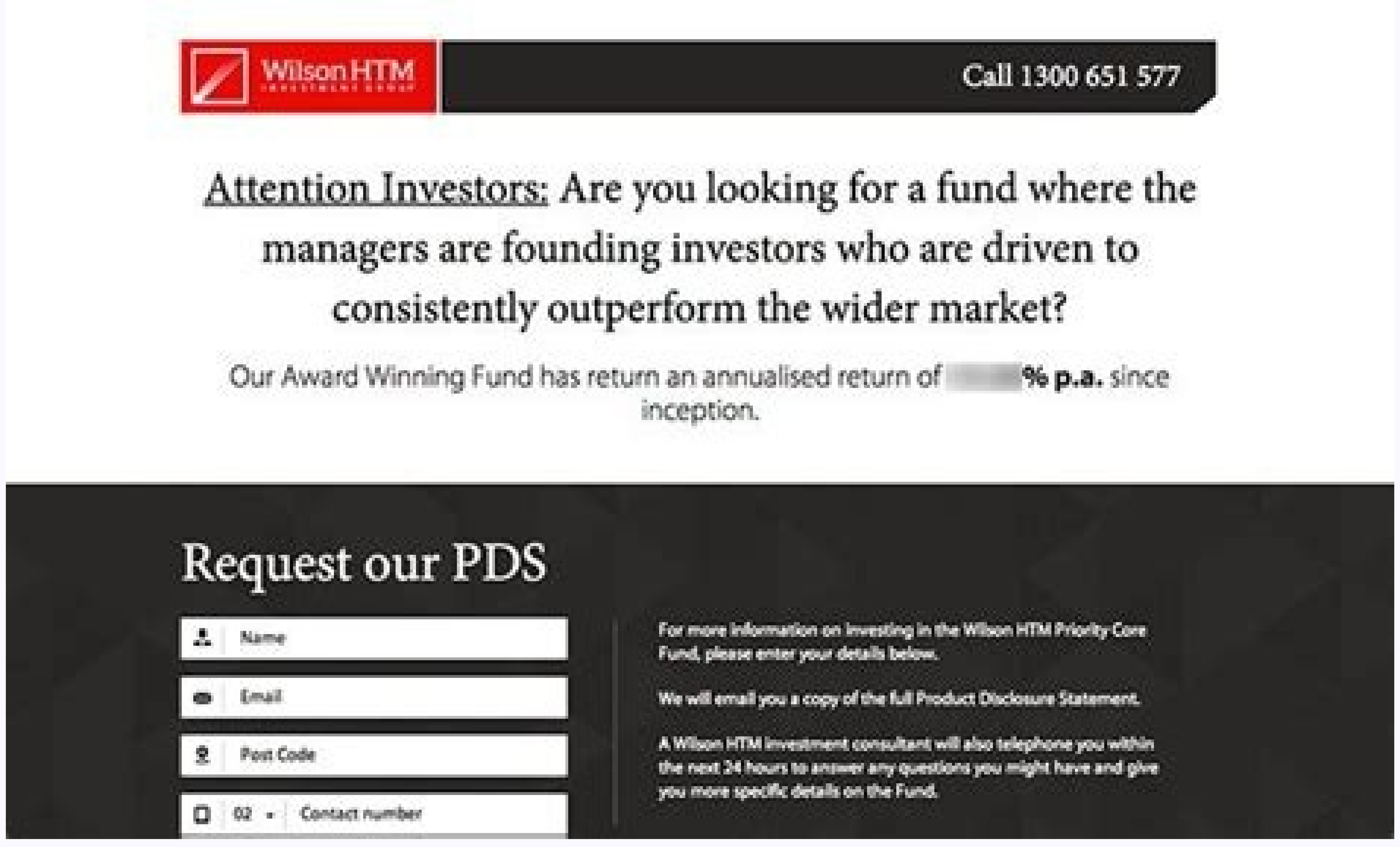


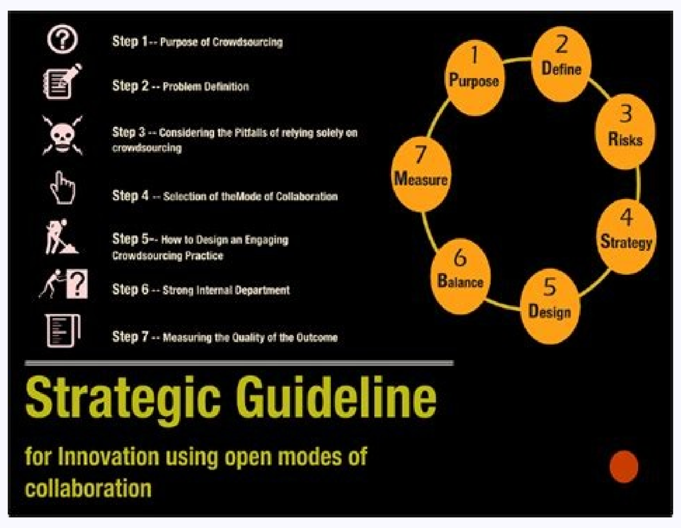




SAE INTERNATIONAL

**On-Line Model Recursive Identification for Variable Parameters of Driveline Vibration**

2017-01-2428

Published 10/08/2017

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CITATION: Dai, P., Huang, Y., Hao, D., and Zhang, T., "On-line Model Recursive Identification for Variable Parameters of Driveline Vibration," SAE Technical Paper 2017-01-2428, 2017, doi:10.4271/2017-01-2428.



**Abstract**

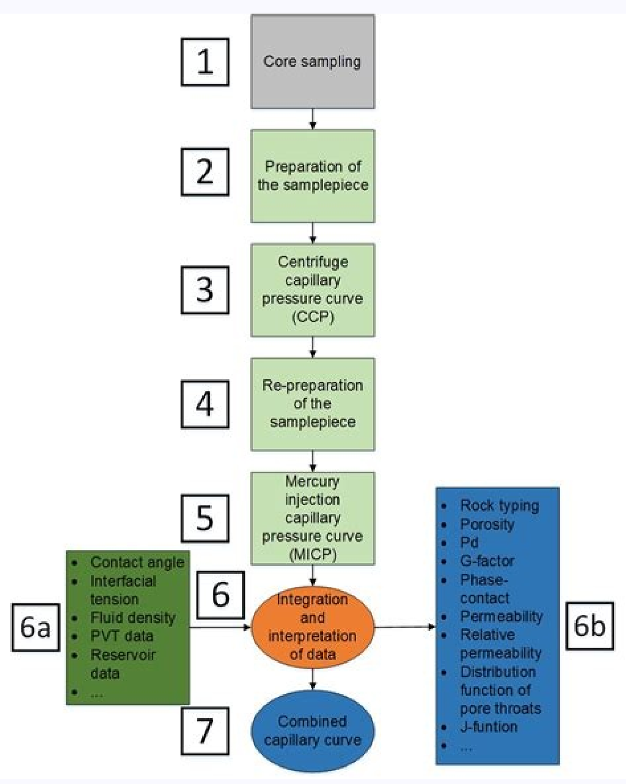
The vehicle driveline suffers low frequency torsional vibration due to the abrupt change of input torque and torque fluctuation under variable frequency. This problem can be solved by model based control, so building a control oriented driveline model is extremely important. In this paper, an on-line recursive identification method is proposed for control oriented model and validated based on an electric car. First of all, the control oriented driveline model is simplified into a six-parameter model with double inertia. Secondly, based on stability analysis, motor torque and motor speed are chosen as input signal for on-line model identification. A recursive identification algorithm is designed and implemented based on Simulink. Meanwhile a detail model of the vehicle which considering driveline parameter variation is built based on ADAMS. Thirdly, on-line identification is conducted by using co-simulation of ADAMS and Simulink. Compared with off-line identification model, the online identification model can reflect dynamic stiffness which will be changing under different excitation frequency and variable vehicle parameters including tire damping and driveshaft damping. Finally, the validation of on-line identification model is conducted under tip-in condition. Results show that outputs of on-line identification model is consistent with the outputs of vehicle model in ADAMS. So, using online identification model, more accurate control will be achieved.

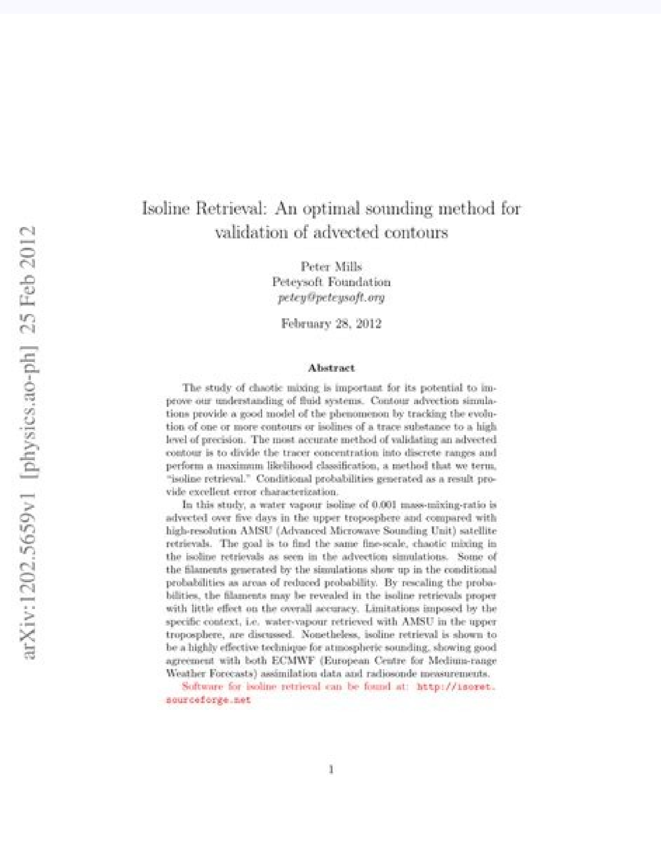
**Introduction**

The existence of elastic elements, rapid acceleration and other abrupt change in torque will cause the driveline torsional vibrations, the torsional vibrations are transmitted along the suspension and then reach the vehicle body, causing low-frequency longitudinal vibration which has a negative impact on the ride comfort of the vehicle. The frequency is below 50 Hz [1]. For the longitudinal vibration of the vehicle body caused by torsional vibration of driveline, the isolation of driveline vibration often requires a lot of parameters calibration and cannot eliminate vibration absolutely [2]. The vibration signal compensated to motor input torque for active control of vibration is commonly used, but this method may remain a delay and have a negative effect on the vehicle dynamic performance [3].

However, the model-based predictive control, considering both comfort and dynamics, offers the optimization function and extract the optimal solution [4]. At the same time, the prediction and the correction of the state variables can be conducted based on the model, then output of the control gives out. As the control structure has a certain prediction and correction, it can be more ideal to achieve control goals. In theory, to achieve the control goal by solving the optimization function, the control model must be the real object itself, but there is an inherent contradiction between control effect and model accuracy. In reality, the control model cannot be the real object, also, complex and accurate control model is commonly difficult to get due to controller design, computing and other requirements. So a simple control oriented model should contain characteristics of the real object as much as possible in certain area to meet the control requirements. For the control problem of driveline torsional vibration, air gap magnetic field and current harmonics of different orders cause the fluctuations of motor torque, tire's non-centroid rotation , uneven mass distribution and radial stiffness inconsistency make the fluctuations of tire's longitudinal force, the fluctuations' frequencies are proportional to the rotating speed [5]. When the excitation frequency is close to the driveline natural frequency, torsional resonance occurs in the driveline. At this time, the stiffness of the driveline can be defined as dynamic stiffness under the excitation of dynamic torque of variable frequency, which is a function of excitation frequency and drastically reduces at resonance. For the driveline with time-varying elastic parameters, the simple time-invariant model cannot reflect the real characteristics of the driveline. Therefore, how to identify a simple control oriented model so that it can accurately reflect the characteristics of real driveline in the model-based predictive control is extremely important.

In the identification of control oriented model for driveline torsional vibration, control oriented model was simplified in terms of physical meaning in [1, 6], it was identified and verified with experiment using wheel speed. In [7], it was assumed that derivative of engine speed



Isoline Retrieval: An optimal sounding method for validation of advected contours

Peter Mills

Peteysoft Foundation

February 28, 2012

arXiv:1202.5659v1 [physics.ao-ph] 25 Feb 2012

Abstract

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