

IDENTIFICATION OF TEST RIG FOR A QUARTER CAR
ACTIVE SUSPENSION SYSTEMS

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Dedicated to

My beloved father and mother, Helmi Ds and Asnah Jon

Who has so much faith in me

Love you always

Also to my below sister and brothers, Elizan, Elly, Efigo, Efriadi, Epi, and Ton

I could have never done it without you

To all my friends, who have stood by me through thin and tick

I treasure you all

Thanks for showering me with love, support and encouragement

Life has been wonderfully colour by you

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ABSTRACT

System Identification approach can be used to estimate model and parameters of the passive system and hydraulic actuator of a test rig for quarter car active suspension system. The passive suspension system is consists of mass, spring, damper, and the hydraulic actuator. Identification of the systems is carried out based on the experimental works. The input to the system is an input signal to control the valve and output from the system are the output signals from the accelerometer and LVDT sensors. Input signal generation and data acquisitions process is controlled by using the LabView. In order to estimate the model and parameter, the data are processes using the System Identification Toolbox in Matlab. Since the system is modelled as a linear model, linear ARX model is utilised as a model structure. Model parameter estimation for the passive system and hydraulic actuator are performed using ARX221 and ARX631, respectively. Through the validation process, percentage of the best fit can be reached more than 90%, and the smallest LF, PFC and AIC criterions also can be reached, hence the model parameters of the systems is acceptable.

ABSTRAK

System Identification dapat digunakan untuk mengira model and parameter dari system pasif dan hydraulic actuator dari pada test rig untuk kereta seperempat dengan system suspension active. Sistem pasif terdiri dari pada spring dan damper, dan hydraulic actuator terdiri dari pada proportional valve dan hydraulic cylinder. Pengenalan bagi kedua sistem berdasarkan pada eksperimen yang dikenakan pada test rig dengan menerapkan Sistem Data Acquisition. DAQ Card NI PCI 6221 digunakan untuk mengambil data masukan dan keluaran dari pada eksperimen. Data masukan adalah sinyal masukan menuju valve dan data keluaran adalah sinyal keluaran dari pada sensor accelerometer dan LVDT. Pembangkitan sinyal masukan dan proses pengambilan data dikawal dengan menggunakan LabView. Untuk melakukan pengiraan model dan parameter, data dipindah dari LabView ke System Identification Toolbox pada Matlab. Kerana system dimodelkan sebagai linear model, maka linear ARX model dipilih sebagai struktur model. Pengiraan parameter model dilakukan menggunakan ARX221 dan ARX631 masing-masing untuk system pasif dan hydraulic actuator. Melalui proses validasi, persen fit paling baik didapatkan lebih dari 90%, dan nilai paling kecil dari pada kriteria LF, PFE dan AIC boleh didapatkan, maka parameter model dari pada sistem boleh dapat diterima.