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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : PROSIDING

Judul Karya Ilmiah : Development of force feedback in steering systems for virtual driving simulator
 Jumlah Penulis : 3 Orang (**Joga Dharma Setiawan**, Masri B. Baharom, M. Ammar Bin Abdul Wal)
 Status Pengusul : Penulis ke-1
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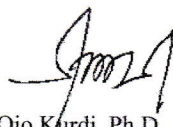
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Eflita Yohana, Ph.D
 NIP. 196204281990012001
 Unit Kerja : Departemen Teknik Mesin FT UNDIP

Semarang, 1 Juni 2021

Reviewer 2



Ojo Kurdi, Ph.D
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 Unit Kerja : Departemen Teknik Mesin FT UNDIP

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Eflita Yohana, Ph.D
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Reviewer 2



Ojo Kurdi, Ph.D

NIP. 197303171999031001

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Development of force feedback in steering systems for virtual driving simulator

Setiawan J.D.^a , Baharom M.B.^b, Bin Abdul Wali M.A.^b

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^a Department of Mechanical Engineering, Faculty of Engineering, Diponegoro University, Indonesia

^b Department of Mechanical Engineering, Universiti Teknologi Petronas, Malaysia

Abstract

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Abstract

In steer-by-wire (SBW) vehicles, the elimination of the rigid mechanical column shaft would require the system to generate an artificial feedback torque which should produce similar driving feeling and behavior as to the conventional steering system. The objective of this study is to evaluate the characteristics of force feedback inside SBW vehicle for driving simulator utilizing Logitech G27 steering wheel. The model of the system is developed in Matlab/Simulink/3D Animation. A J-turn test is performed to see the resulting handwheel torque and its effect on the vehicle dynamic. The evaluation shows that the results are reasonable such that the driver of the simulator can feel the similar forces coming from the real road. © The Authors, published by EDP Sciences, 2018.

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(2016) Proceedings - 2015 IEEE
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SMC 2015

An ADAS-Oriented Virtual EPS
Platform Based on the Force
Feedback Actuator of the Steer-
by-Wire System

- ☐ 1 Fahami, S.M.H., Zamzuri, H., Mazlan, S.A.
Development of estimation force feedback torque control algorithm for driver steering feel in vehicle steer by wire System: Hardware in the loop ([Open Access](#))

(2015) *International Journal of Vehicular Technology*, 2015, art. no. 314597. Cited 19 times.
<http://www.hindawi.com/journals/ijvt/>
doi: 10.1155/2015/314597

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- ☐ 2 Mandhata, U.B., Jensen, M.J., Wagner, J.R., Switzer, F.S., Dawson, D.M., Summers, J.D.

Evaluation of a customizable haptic feedback system for ground vehicle steer-by-wire interfaces

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Investigations into the effects of maximum deflection in low stiffness resilient shaft of Semi Active Steering System

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Modeling and experimental design approach for integration of conventional power steering and a steer-by-wire system based on active steering angle control

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Architectures for Shared Control of Vehicle Steering

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□ 7 Avinash, B.
Artificial steering feel design for steer-by-wire vehicles
(2013) *7th IFAC Symposium On Advances in Automotive Control*
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Rando Tungga Dewa, Jeong-Hun Park, Seon-Jin Kim, Woo-Gon Kim, Eung-Seon Kim, Gunawan D. Haryadi and I. M. W. Ekaputra

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Joga Dharma Setiawan, Masri B. Baharom and M. Ammar Bin Abdul Wali

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Sendie Yuliarto Margen, S Sulisty, Sri Nugroho and Yoga Setiawan Adi Nugroho

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Wa Ode Nirwana Sari Halidun, Eka Cahya Prima, Brian Yuliarto and Suyatman

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Djarot B. Darmadi, Widia Setiawan, Anindito Purnowidodo and Eko Siswanto

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Development of force feedback in steering systems for virtual driving simulator

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Abstract. In steer-by-wire (SBW) vehicles, the elimination of the rigid mechanical column shaft would require the system to generate an artificial feedback torque which should produce similar driving feeling and behavior as to the conventional steering system. The objective of this study is to evaluate the characteristics of force feedback inside SBW vehicle for driving simulator utilizing Logitech G27 steering wheel. The model of the system is developed in Matlab/Simulink/3D Animation. A J-turn test is performed to see the resulting handwheel torque and its effect on the vehicle dynamic. The evaluation shows that the results are reasonable such that the driver of the simulator can feel the similar forces coming from the real road.

1 Introduction

A steering wheel is one of the contributing factors that plays an important role in enhancing the safety of the passenger beside maintaining the vehicle stability. Inside a typical steering system, the driver's steering input is transmitted by a steering shaft through a type of gear mechanism to generate steering motion at the front wheels. Nowadays, power steering assist has become a standard built-in feature inside most of road vehicles. The power steering amplifies the driver's-applied torque at the steering wheel such that steering effort is reduced.

Steer-by-wire (SBW) system utilizes the by-wire technology to perform and also augment existing functions of mechanical steering systems. The term "by-wire" can also be referred to as the replacement of mechanical controls to the electronic system. SBW systems have no mechanical linkage (steering column) between the steering wheel and the rack and pinion gear system [1]. SBW system omits the intermediate shaft available in conventional vehicles, which allows the possibility of independently commanding the roadwheels through both driver and lane-keeping assistance system [2]. This study produces an algorithm for producing steering feedback torque using Simulink for virtual experimentation.

2 Research Methodology

2.1 Bicycle Model with Artificial Force Feedback Model

A bicycle model of a car is used as a reference model for three degree-of-freedom (DOF) in the driving simulator as shown in Fig. 1(a) and represented by Eqs. (1-3). An artificial force

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Fatigue Testing and Evaluation of Fatigue Strength under Multiaxial Stress State; Why do we need fatigue testing?

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Abstract. Types of multiaxial fatigue tests and their experimental results are presented in this paper. There are typical three types in multiaxial fatigue tests: the combining push-pull and reversed torsion loading test using hollow cylinder specimen, the biaxial tension-compression test using cruciform specimen and the inner pressure applied the push-pull loading test using the hollow cylinder specimen. In the combining a push-pull loading and a reversed torsion loading test, failure life under non-proportional loading in which principal directions of stress and strain were changed in a cycle was shortened compared to proportional loading in which those are fixed. Fatigue lives were well-correlated using a non-proportional strain range considering the effect of strain path and material dependence. In the biaxial tension-compression test, the failure life decreased with increase of the principal strain ratio. In the inner pressure applied the push-pull loading test, cyclic deformation behaviour due to complex loading paths of multiaxial fatigue tests with the inner pressure associated with push-pull and rev. torsion acted to reduce the failure lives. Experimental investigation of multiaxial failure life and elucidation of their governing mechanism is essential and it can broaden the applicability of structural components.

1 Introduction

Investigation of fatigue properties is essential for design of structural components. In practical application, structures are subjected to complex multiaxial load. Therefore, the understanding of multiaxial fatigue properties of materials is important. Indeed, failure lives are overestimated when the effect of multiaxiality is neglected. Multiaxial fatigue testing usually has been carried out using a hollow cylinder specimen by applying push-pull loading and a reversed torsion loading and the applicability of multiaxial stress and strain parameters has been discussed [1-5]. However, a principal strain ratio (ϕ) and a principal stress ratio (λ) ranges performable by the testing method are $-1 \leq \phi \leq -\nu$ and $-1 \leq \lambda \leq 0$, where ν is the Poisson's ratio. Structural components sometimes undergo fatigue damage at principal strain/stress ratios in excess of the above range under service loading. In

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Simulation and analysis of the aeroelastic-galloping-based piezoelectric energy harvester utilizing FEM and CFD

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Abstract. Due to a large oscillation amplitude, galloping can be an admissible scenario to actuate the piezoelectric-based energy harvester. In the case of harvesting energy from galloping vibrations, a prismatic bluff body is attached on the free end of a piezoelectric cantilever beam and the oscillation occurs in a plane normal to the incoming flow. The electrical power then can be extracted from the piezoelectric sheet bonded in the cantilever structure due to the dynamic strain. This study is proposed to develop a theoretical model of a galloping-based piezoelectric energy harvester. A FEM procedure is utilized to determine dynamic characteristics of the structure. Whereas the aerodynamic lift and drag coefficients of the tip bluff body are determined using CDF. The results show that the present method gives precise results of the power generated by harvester. It was found that *D*-section yields the greatest galloping behavior and hence the maximum power.

1 Introduction

The lifespan limitation of small batteries is one of the main challenges in the standalone systems/self-power devices application such as a wireless sensor network [1]. Structural vibration is one of the most used mechanical domain which enables to be converted into electrical field by utilizing several well-known energy harvester. Piezoelectric-based vibration energy harvester has been used as favorable transduction mechanism by many researchers due to its simplicity, efficient and wide range operational frequencies. There are many studies have been published aiming the investigation of piezoelectric energy harvester as an electronic devices power supply, either as redundant charging system or primary power supply [2,3,4,5]. There are increasing research interest of aeroelastic-based energy harvesters including vortex-induced-based and galloping-based energy harvesters. Galloping is one of the classical aeroelastic instabilities phenomena which can be

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An Integration of PSO-based Feature Selection and Random Forest for Anomaly Detection in IoT Network

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Abstract. The most challenging research topic in the field of intrusion detection system (IDS) is anomaly detection. It is able to repeal any peculiar activities in the network by contrasting them with normal patterns. This paper proposes an efficient random forest (RF) model with particle swarm optimization (PSO)-based feature selection for IDS. The performance model is evaluated on a well-known benchmarking dataset, i.e. NSL-KDD in terms of accuracy, precision, recall, and false alarm rate (FAR) metrics. Furthermore, we evaluate the significance differences between the proposed model and other classifiers, i.e. rotation forest (RoF) and deep neural network (DNN) using statistical significance test. Based on the statistical tests, the proposed model significantly outperforms other classifiers involved in the experiment.

1 Introduction

The present escalation of Internet of Things (IoT) devices and services has changed our daily life dramatically. Many applications are built based on IoT technologies, i.e. smart cities, smart health care, smart home and vehicular networks [1]. Apart from these benefits, attackers may take this such opportunity to launch malevolent code or program to the network. According to [2], security is a key barrier of the implementation of IoT network and services. This is because IoT works with different standard and protocol forming a heterogeneous network. Moreover, IoT devices prevalently produce a huge amount of data so it might become a big threat as malicious users can intercept the data while it is transmitted.

As the development of IoT devices increase, insecure information processing might immediately affects to the whole IoT network. The jeopardy of information disclosure in public space will increase caused by the broadly development of IoT. As presented in Figure 1, security architecture in IoT is divided into three layers, i.e. perception layer, transportation layer, and application layer [3] [4]. Transportation layer comprises network access security which is responsible for attack detection and prevention. An intrusion detection system (IDS) is one security solution which can be deployed in the transportation

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