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

Judul Karya Ilmiah	:	The Effect of Vehicle Inertia on Regenerative Braking Systems of Pure Electric Vehicles			
Jumlah Penulis	:	6 Orang 6 Orang (**Joga Dharma Setiawan**, B. A. Budiman, I Haryanto, M. Munadi, M. Ariyanto, M. Alfian)			
Status Pengusul	:	Penulis ke-1			
Identitas Prosiding	:	a.	Judul Prosiding	:	6th International Conference on Electric Vehicular Technology, ICEVT 2019; Bali; Indonesia; 18 November 2019 through 21 November 2019
		b.	ISBN/ISSN	:	ISBN: 978-172812917-4
		c.	Thn Terbit, Tempat Pelaks.	:	Bali, Indonesia, 18-21 November 2019
		d.	Penerbit/Organiser	:	Institute of Electrical and Electronics Engineers Inc.
		e.	Alamat Repository/Web	:	https://www.ieee.org/
			Alamat Artikel	:	https://ieeexplore.ieee.org/abstract/document/8993977
		f.	Terindeks di (jika ada)	:	Scopus

Kategori Publikasi Makalah (beri ✓pada kategori yang tepat) : [√] *Prosiding* Forum Ilmiah Internasional
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Total = (100%)	**23,5**	**24,00**	**23,75**
Nilai Pengusul = (60%x23,75) = 14,25			

Reviewer 2

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Semarang, 1 Juni 2021
Reviewer 1

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LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
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		f.	Terindeks di (jika ada)	:	Scopus

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Komponen Yang Dinilai	Nilai Maksimal Prosiding: Internasional [√]	Nilai Maksimal Prosiding: Nasional [ ]	Nilai Akhir Yang Diperoleh
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b. Ruang lingkup dan kedalaman pembahasan (30%)	7,50		7,00
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,50		7,00
d. Kelengkapan unsur dan kualitas terbitan /prosiding (30%)	7,50		7,50
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2. **Ruang lingkup dan kedalaman pembahasan:**
Artikel ini memnahas tentang pengaruh inersia kendaraan listrik terhadap system regenerative breaking. Pemodelan regenerative breaking telah dikembangkan baik secara model matematis maupun dengan model simulasi yang dikembangkan dalam MATLAB/Simulink. Hasil simulisi tentang profile dari regenerative breaking telah disajikan dengan runtut dan jelas.
3. **Kecukupan dan kemutakhiran data/informasi dan metodologi:**
Artikel yang diusulkan mempunyai tingkat kemutakhiran yang cukup baik yaitu dengan mengajukan studi regenerative braking ditinjau dari pengaruh inersia kendaraan listrik. Hasil simulasi ditunjukkan dalam plot grafik yang cukup lengkap dan interaktif. Hasil studi menunjukkan dengan masa yang lebih besar diperlukan waktu pengeraman yang lebih lama dan braking efficiency yang lebih rendah.
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Reviewer 1

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Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Maksimal Prosiding: Internasional [√]	Nilai Maksimal Prosiding: Nasional [ ]	Nilai Akhir Yang Diperoleh
e. Kelengkapan unsur isi prosiding (10%)	2,50		2,00
f. Ruang lingkup dan kedalaman pembahasan (30%)	7,50		7,50
g. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	7,50		7,00
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2. **<u>Ruang lingkup dan kedalaman pembahasan:</u>**
   Paper ini membahas tentang pengaruh inersia kendaraan listrik pada regenerative breaking yang dihasilkan. Hasil dari pemeodelan pada regenerative breaking telah disajikan dengan lengkap dalam bentuk grafik dan model matematis.
3. **<u>Kecukupan dan kemutakhiran data/informasi dan metodologi:</u>**
   Metode penelitian yang digunakan sudah dibahas cukup detail. Persamaan pemodelan matematika regenerative breaking sudah dibahas dan hasilnya ditampilkan dalam plot grafik. Efek dari inersia terhadap regenerative breaking yang dihasilkan disajikan dengan menarik.
4. **<u>Kelengkapan unsur dan kualitas terbitan:</u>**
   IEEE explore merupakan publisher yang sudah baik. Prosiding ini telah terindex Scopus.

Semarang, 1 Juni 2021
Reviewer 2

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6TH ICEVT 2019

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ICEVT 2019 - Proceeding: 6th International Conference on Electric Vehicular Technology 2019 • Pages 179 - 188 • November 2019 • Article number 8993977 • 6th International Conference on Electric Vehicular Technology, ICEVT 2019, 18 November 2019 - 21 November 2019

The Effect of Vehicle Inertia on Regenerative Braking Systems of Pure Electric Vehicles

Setiawan J.D.[a, b], Arief Budiman B.[b, c], Haryanto I.[a, b], Munadi[a, b], Ariyanto M.[a, b], Hidayat M.A.[a]

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Abstract

Electric vehicles have the advantage of regenerative braking in which the electric motor can be used as a generator to convert the kinetic energy of a moving vehicle into electrical energy during the braking process. The purpose of this study is to determine the effect of vehicle inertia on the voltage and electrical power profiles at the ultracapacitors as the energy storage system (ESS) and the vehicle speed during the motoring and the generating modes. In this study, an induction motor is used. The combination of regenerative and mechanical braking systems is regulated by the control logic to meet the driver's request. The mathematical model of a regenerative parallel braking system is coded in MATLAB/Simulink. The simulation results show the profiles of electric power flow, energy flow

MATLAB/Simulink. The simulation results show the profiles of electric power flow, energy flow, mechanical braking torque, braking torque by the motor, and the State of Charge (SOC) of the ultracapacitor stacks.

Author keywords

flywheel; generating mode; regenerative braking; SOC; ultracapacitors

Indexed keywords

SciVal Topics

Metrics

Funding details

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1 Ehsani, M., Gao, Y., Gay, S.E., Emadi, D.A.
(2003) *Modern Electric, Hybrid Electric, and Fuel Cell Vehicles-Fundamentals, Theory, and Design*. Cited 1187 times.
Boca Raton, Florida: CRC Press, Ltd. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (references)

2 Krishnan, R.
(2001) *Electric Motor Drives: Modeling, Analysis, and Control*. Cited 1396 times.
New Jersey Prentice Hall Inc

3 Todd Philip, C.
(2001) *Snubber Circuits: Theory, Design, and Application*. Cited 37 times.
Technical report, Texas Instruments Incorporated

4 Westbrook, M.
(2001) *The Electric Car: Development and Future of Battery, Hybrid and Fuel-Cell Cars*. Cited 58 times.
London, England: The Institution of Engineering and Technology

5 Miller John, M.
(2010) *Propulsion Systems for Hybrid Vehicles*. Cited 229 times.
2nd ed. London, England: The Institution of Engineering and Technology

6 Demers Steven, M.
(2008) *Mechanical and Regenerative Braking Integration for A Hybrid Electric Vehicle*. Cited 2 times.
Tesis. The University of Waterloo

☐ 7 Hedrick Dan, C.G.J., Karl, J.
Brake System Modeling for Simulation and Control
(1999) *ASME*, 121, p. 496. Cited 2 times.

☐ 8 Wu, M.-C., Shih, M.-C.
Simulated and experimental study of hydraulic anti-lock braking system using sliding-mode PWM control

(2003) *Mechatronics*, 13 (4), pp. 331-351. Cited 126 times.
doi: 10.1016/S0957-4158(01)00049-6

View at Publisher

☐ 9 Panagiotidis, M., Delagrammatikas, G., Assanis, D.
Development and use of a regenerative braking model for a parallel hybrid electric vehicle

(2000) *SAE Technical Papers*. Cited 36 times.
http://papers.sae.org/
doi: 10.4271/2000-01-0995

View at Publisher

☐ 10 Fajri, P., Ahmadi, R., Ferdowsi, M.
Equivalent vehicle rotational inertia used for electric vehicle test bench dynamic studies

(2012) *IECON Proceedings (Industrial Electronics Conference)*, art. no. 6389231, pp. 4115-4120. Cited 29 times.
ISBN: 978-146732421-2
doi: 10.1109/IECON.2012.6389231

View at Publisher

☐ 11 Liu, Q., Qu, F., Song, J.
A novel dual function pneumatic valve for blending braking system and control strategies

(2017) *2017 International Conference on Mechanical, System and Control Engineering, ICMSC 2017*, art. no. 7959482, pp. 255-261. Cited 2 times.
ISBN: 978-150906529-5
doi: 10.1109/ICMSC.2017.7959482

View at Publisher

☐ 12 Rashid, M.H.
(2011) *Power Electronics Handbook: Devices Circuits and Applications Handbook*. Cited 1242 times.
USA: Butterworth-Heinemann

☐ 13 Qiu, C., Guolin, W., Meng Mingyu, D.
A novel control strategy of regenerative braking system for electric vehicles under safety critical driving situations
(2018) *Energy*

14 Prince, A., Abraham, P.K., Aryanandiny, B.
Design and implementation of ultra capacitor based regenerative braking system for a DC motor

(2018) *2018 International Conference on Emerging Trends and Innovations In Engineering And Technological Research, ICETIETR 2018*, art. no. 8529066. Cited 5 times.
http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8510758
ISBN: 978-153865744-7
doi: 10.1109/ICETIETR.2018.8529066

View at Publisher

15 Bhurse, S.S., Bhole, A.A.
A Review of Regenerative Braking in Electric Vehicles

(2018) *7th IEEE International Conference on Computation of Power, Energy, Information and Communication, ICCPEIC 2018*, art. no. 8525157, pp. 363-367. Cited 8 times.
http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8501333
ISBN: 978-153862447-0
doi: 10.1109/ICCPEIC.2018.8525157

View at Publisher

16 Farshid, N., Ebrahim, F., Ghanbari Teymoor, D.
(2016) *An Efficient Regenerative Braking System Based on Battery/Supercapacitor for Electric, Hybrid and Plug-In Hybrid Electric Vehicles with BLDC Motor*
IEEE

17 Debajit Kumar, S., Kalita Bubumani, D.
(2017) *A Study on Regenerative Braking System with Matlab Simulation*
IEEE

18 Binesh Mohan, P., Bindu, V.R.
Energy Regeneration in Induction Machine Drive during Braking

(2018) *Proceedings of the 2nd International Conference on Trends in Electronics and Informatics, ICOEI 2018*, art. no. 8553829, pp. 91-95.
http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8536212
ISBN: 978-153863570-4
doi: 10.1109/ICOEI.2018.8553829

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6TH ICEVT 2019

CONFERENCE PROCEEDING

6TH INTERNATIONAL CONFERENCE ON ELECTRIC VEHICULAR TECHNOLOGY 2019

NOVEMBER 18-21, 2019
FOUR POINTS BY SHERATON BALI, UNGASAN

ORGANIZED BY:

National Center for Sustainable Transportation Technology

INSTITUT TEKNOLOGI BANDUNG 1920

UNIVERSITAS UDAYANA

6TH ICEVT 2019 SCHEDULE

Monday, November 18, 2019

Time	Activity
All Day	Participant check-in

Tuesday, November 19, 2019 (ICEVT Day 1)

Time	Activity
7:30	Registration Open
08:00-09:00	Opening Ceremony: • Dr. Agus Purwadi – Chairman of 6th ICEVT 2019 • Prof. Dr. dr. A. A. Raka Sudewi, Sp.S (K) – Rector of Universitas Udayana • Prof. Ir. Kadarsah Suryadi – Rector of Institut Teknologi Bandung • Prof. Dr. Bambang Permadi Soemantri Brodjonegoro, S.E., M.U.P., Ph.D. – Minister of Research and Technology/Chairman of Agency for National Research and Innovation *"Arah Kebijakan Riset dan Inovasi Nasional dalam Menyongsong Revolusi Kendaraan Listrik"*
09:00-09:35	Keynote Session 1 by Prof. Qing Zhou (Tsinghua University) *"Failure Mechanisms of Lithium-ion Batteries under Mechanical Loading"*
09:35-10:10	Keynote Session 2 by Prof. Elham Sahraei (Temple University) *"Homogenized Modelling and Failure Characterization of Lithium-ion Battery for Electric Vehicle Application"*
10:10-10:45	Keynote Session 3 by Prof. Simon Shepherd (University of Leeds) *"A Reflection on using Product Diffusion Models in Forecasting the Electric Vehicle Market"*
10:45-11:20	Keynote Session 4 by Dr. Stephan Brandl (AVL Austria) *"Development of an Integrated Axle for MD Trucks for Urban Distribution Traffic"*
11:20-11:55	Keynote Session 5 by Prof. Kikuo Kishimoto (Tokyo Institute of Technology) *"Multi-Material Structures and Mechanics of Materials Research"*
11:55-13:25	Lunch Break
13:25-15:00	Parallel Session 1
15:00-15:30	Coffee Break
15:30-17.00	Parallel Session 2
19:00-21:00	Gala Dinner

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TABLE OF CONTENTS

INVITED PAPERS

PARALLEL SESSION 1 SCHEDULE Padang-padang 1 Meeting Room

PARALLEL SESSION 1 SCHEDULE Padang-padang 2 Meeting Room

PARALLEL SESSION 1 SCHEDULE Balangan 1 Meeting Room

PARALLEL SESSION 1 SCHEDULE Balangan 2 Meeting Room

PARALLEL SESSION 1 SCHEDULE Balangan 3 Meeting Room

PARALLEL SESSION 2 SCHEDULE Padang-padang 1 Meeting Room

PARALLEL SESSION 2 SCHEDULE Padang-padang 2 Meeting Room

2019 6th International Conference on Electric Vehicular Technology (ICEVT)
November 18-21, 2019, Bali, Indonesia

The Effect of Vehicle Inertia on Regenerative Braking Systems of Pure Electric Vehicles

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***Abstract*—Electric vehicles have the advantage of regenerative braking in which the electric motor can be used as a generator to convert the kinetic energy of a moving vehicle into electrical energy during the braking process. The purpose of this study is to determine the effect of vehicle inertia on the voltage and electrical power profiles at the ultracapacitors as the energy storage system (ESS) and the vehicle speed during the motoring and the generating modes. In this study, an induction motor is used. The combination of regenerative and mechanical braking systems is regulated by the control logic to meet the driver's request. The mathematical model of a regenerative parallel braking system is coded in MATLAB/Simulink. The simulation results show the profiles of electric power flow, energy flow, mechanical braking torque, braking torque by the motor, and the State of Charge (SOC) of the ultracapacitor stacks.**

***Keywords*— regenerative braking, SOC, ultracapacitors, flywheel, generating mode**

I. Introduction

Electric vehicles have the advantage of regenerative braking. An electric motor which is usually used as a driver can be used as a generator to convert the kinetic energy of a vehicle into electrical energy during the braking process, rather than removing heat energy. This electrical energy can then be stored in energy storage systems (eg batteries or ultracapacitors) and then released to electric motors as driving vehicles.

Regenerative braking must operate safely and effectively, therefore the regenerative and mechanical braking system must be fully integrated. This integration requires a combination of regenerative and mechanical braking to be controlled smoothly and accurately to meet the driver's demand.

Regenerative braking torque settings are carried out using control algorithms and vector control for induction motors. In overcoming the problem of setting braking torque separately from the driving force of the pedal by using a reduction in pressure on the brake booster to regulate the amount of mechanical torque developed by the braking system

II. Methods of Regenerative Braking

A. Parallel Regenerative Braking

During parallel regenerative braking, both the electric motor and the mechanical braking system always work in parallel (together) to slow the vehicle down shown in Fig. 1 [1]. Because mechanical braking cannot be controlled independently of the brake pedal force, this changes part of the kinetic energy of the vehicle into heat, not electrical energy. The regenerative braking force developed by the electric motor is a function of the hydraulic pressure of the master cylinder, and therefore a function of vehicle deceleration. Because the regenerative braking force available is a function of motor speed and because almost no kinetic energy can be recovered at low motor speed, the regenerative braking force at high vehicle deceleration is designed to be zero so as to maintain braking balance. The parallel braking system does not need an electronically controlled mechanical brake system. A pressure sensor senses the hydraulic pressure in the master cylinder, which represents the deceleration demand. The pressure signal is regulated and sent to the electric motor controller to control the electric motor to produce the demanded braking torque. This is not the most efficient regenerative braking method. However, parallel regenerative braking does have advantages because it is simple and cost-effective. For the use of this method, the mechanical braking system requires a little modification and the control algorithm for the electric motor can be easily

2019 6th International Conference on Electric Vehicular Technology (ICEVT)
November 18-21, 2019, Bali, Indonesia

Development of an Integrated Axle for MD Trucks for Urban Distribution Traffic

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***Abstract*— The need for zero emission transport solutions in urban areas is strongly driven by topics like local air pollution, noise emissions as well as global CO2 reduction and public pressure. One solution for this demand are battery electric vehicles with the focus to provide emission free urban transportation combined with lowest total cost of ownership and consequently a positive business case for the end customers. Requirements and approaches to achieve this important goal are discussed in this paper.**

Keywords—electrification, e-axle, cooling, powertrain integration

I. Introduction

To enable the transition to electrified transportation, AVL is developing e-drive solutions for buses as well as light-, medium- and heavy-duty commercial vehicle applications. As an application for buses was already presented together with ZIEHL-ABEGG at the 39th Vienna Engine Symposium [1], this paper will focus on applications for commercial vehicles.

In the field of commercial vehicles, solutions with slow rotating e-motors which drive a conventional axle via a cardan shaft struggle with the main challenges of electric range, product cost, system weight and vehicle packaging.

The solution presented here is a concept of a medium-duty commercial vehicle e-axle developed by AVL which can be quickly transferred into a series development project. With this concept of an integrated electrical axle for urban truck application (16 ton GVW), this approach overcomes the zero emission challenges and defines a new class of commercial vehicle electric axles.

The full integration of a high speed e-motor, power electronics, 2-speed reduction transmission and a dual temperature oil cooling system minimizes the interfaces to the vehicle. The compact packaging allows a large battery size placed crash-safe in between the vehicle frame rails for an increased electric range. The high degree of integration enables optimized solutions in terms of product cost and system weight.

This paper shows the architecture of the e-axle, explains the main specifications and presents design solutions for the integration of all required components into the new electrically driven axle. Furthermore, a solution for the cooling system for the e-axle components is described.

II. System Specification

The simplest way to install an electric drive into a truck is to place an off-the-shelf electric motor into the vehicle frame which drives a conventional truck axle via a cardan shaft. In this case the batteries need to be packaged at both sides of the vehicle. In the future increasing production volume are expected. That allows more optimized solutions. By the integration of the e-drive components into the axle the batteries can be positioned crash-safe in between the frame rails. Both variants are shown in Fig. 1.

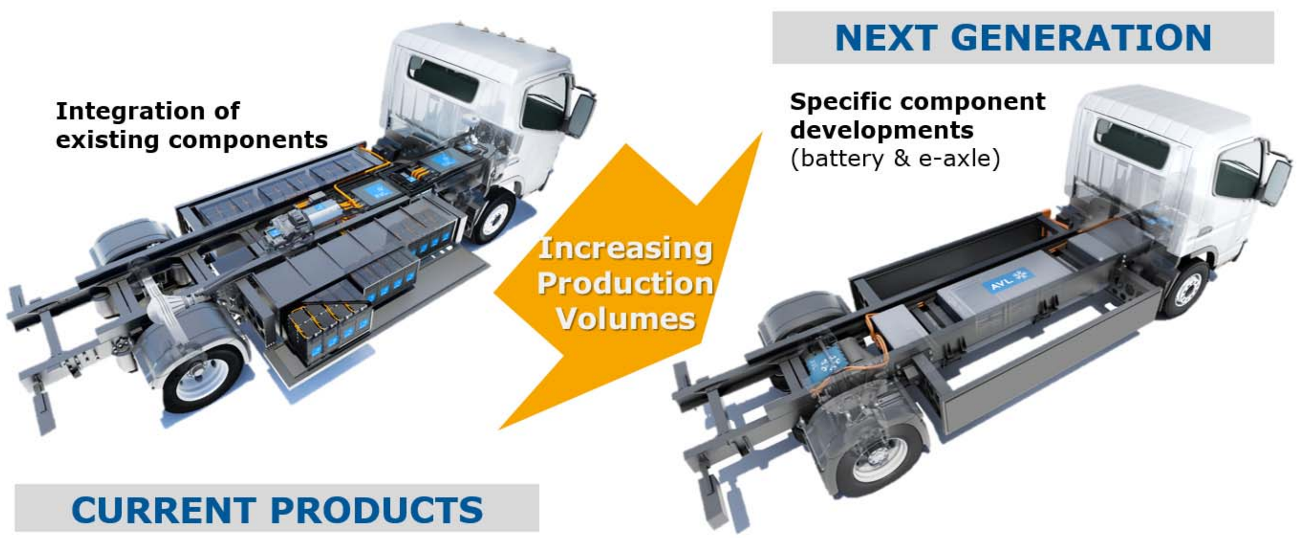

Fig. 1 E-drive concepts for trucks

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Modeling, Identification and Simulation of Hybrid Battery/Supercapacitor Storage System Used in Vehicular Applications

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***Abstract*—Energy storage system would play a crucial role in the electric and hybrid vehicle applications. This paper presents modeling, identification and validation of the behavior of two energy storage devices, battery and supercapacitor, used for a hybrid energy storage system (HESS) in electric vehicle applications. Besides of both main storage elements, the HESS includes bi-directional DC/DC power converters suitable for power electronic interface between the battery main energy storage system and the supercapacitor. Design and modeling of the DC/DC power converter is discussed in this study. The electric state-space models of both power sources, battery and supercapacitor, are also developed. And following that lead, the identification of both storage components constituting the HESS is carried out via many optimization methods based on laboratory experimental data of an urban electric vehicle. The obtained results show the good performance of the state space developed models comparing with the experimental results from a test bench developed in our laboratory.**

Keywords— electric vehicle, hybrid energy storage system, lithium-ion battery, supercapacitor, optimization algorithm, bidirectional DC/DC converter, state space, identification, test bench

I. INTRODUCTION

The energy transition in the field of individual transport requires first of all change in thinking: Do we need such important mobility ranges in our everyday lives? How to use the vehicles stopping times for battery charging?...etc. However, this energy transition also requires technological improvements, mainly in the storage of electrical energy. In this context, the electric vehicle application is a rather particular field of application since it requires both a high degree of energy and a high-power requirement. It tends not to be compatible with existing storage systems. One of the ideas to overcome this problem is to use a High Energy lithium-ion battery (HE) coupled with supercapacitors [1], [2]. The latter is used as a buffer to assist and preserve the battery, by responding to high and medium changes of current. It can also be charged during the deceleration and braking phases [3]. In this case, the battery only sees the slow current changes. By taking full advantage of each of the two energy storage units, HESS can effectively satisfy the varying power and energy requirements and hence can increase the power availability [3], [4]. In addition, the application of HESS to an electric drivetrain (e-motor) can be used to fulfill one or more of the following requirements: (1) to improve the efficiency of the electric system, (2) to reduce the sizes and cost of battery, and (3) to provide better lifetime of energy supply.

The key issue in battery/supercapacitor HESS is energy management [1],[5]. It means defining the optimal power flows assignment between the battery energy source and the supercapacitor auxiliary power source, which can play a non-negligible role in the effectiveness and the performance of the electric drivetrain system. In this context, how to effectively split power is a major challenge in HESSs [1]. Many power management strategies have been proposed for HESSs in literature, ranging from rule-based or fuzzy logic control approaches to optimization-based strategies, and model predictive control methods [6],[7],[8].

In order to design and evaluate energy management for HESS, device models that are suitable for the system-level simulations are required. Due to the complexity of internal characteristics and sensitivity to the ambient conditions, lithium-ion batteries are of special interest in the device modeling phase. Different battery models have been extensively reported in the literature in the last few years [9].

In this paper, the modeling, identification and simulation of a lithium-ion battery/supercapacitor HESS in electric vehicle applications are proposed. The main contributions of the paper are as follows: a lithium-ion battery state-space model suitable for the system-level applications is constructed based on the laboratory experimental tests. By considering the behavior of DC/DC power converter and supercapacitor, the proposed model reflects the HESS dynamics accurately without relying on complicated calculations [3][4].

The remainder of the paper is organized as follows: **Section 2** shows the proposed hybrid energy storage system topology, **Section 3** describes modeling, identification of parameters, and simulation results of the DC/DC converter, **Section 4** illustrates modeling, identification of parameters, and simulation results of the Li-ion battery, **Section 5** presents modeling, identification of parameters, and simulation of the supercapacitor, and **Section 6** offers conclusion and a description of future work.

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Channel Measurement-based Ray-tracing Analysis for High Speed Railway Scenario at 800MHz

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***Abstract* – The analysis of channel measurement based ray-tracing (RT) simulation nowadays is considered as one of the most effective in solving traffic railway communication. In order to handle the increasing capacity demand for higher transmission capabilities, the railway communication system should be support by high data rate conectivity and feasible in many areas included urban area. The channel characteristic for railway scenario are explored by RT analysis method in the simulation at 800 MHz with 20 MHz bandwidth. Also most straightforward way to increase capacity is to add more bandwidth. The scenario for high speed railway (HSR) are modeling in urban area. However due to channel information parameters are extracted and incorporated into a 3GPP-like random channel generator. Well to analysis the channel mesurement depend on ray-tracing for HSR can be adjusted with the channel information on the area.**

Keywords* – *channel measurement, ray tracing, bandwidth, and modeling

I. Introduction

Smart railway communication networks are inevitable elements of modern railways. This is because communication networks are fundamental for vital railway services such as train command-control systems and railway emergency call. These services greatly improve railway safety and efficiency (e.g. by ensuring that trains always obey signals and by providing more detailed information to train drivers, what allows reaching higher speeds and maximize track occupancy). Voice and Data communications are still very important services for railways. Railway communication technology needs not only to provide point-to-point calls as commercial mobile telephony does, but also to provide railway-specific features such as group calls, broadcast calls, call prioritization and advanced addressing based on location or function (e.g. calling a train dispatcher responsible for a given area). In other case the people needed to access the internet as main data communication. So the main problem here is how to modeling channel characteristic with RT simulation to be feasible in urban area. The main simulation should be caribrated by many material environment which is suitable with the urban location[1][2].

Major problem in analysis channel measurement for railway communication system are multi-path effect and root-mean-square (RMS) delay spread[1][3]. However the multi-path effect is not only reduce the received power in receiver (Rx) but it can move the phase of received power, although the amplitude of the signal is constant as like as transmitted signal but in general the phase of the signal would not be the same as like as transmitted signal. And also for RMS delay spread, the received signal would be delayed. The delay occur when the electromagnetic (EM) signal from transmitter (Tx) passed the zone as like antenna patterns, and the signal is transmitted from Tx to Rx made two type rays that called by direct path and scattering path. The direct path is line of sight (LOS) communication path without any obstacle, the signal would be transmitted directly to Rx. While the scattering path is not clearly communication path, it can be reflected, refracted or interfered with any obstacle[4][5]. Now the RT simulation for railway communication can solve to find RT analysis of channel measurement scenario at 800MHz in urban environment. The model of urban environment are made by Sketchup program, and for the materials of the environment belong to RT simulation.

The remainder of this paper is organized as follows. In section II the propagation mechanisms, RT method and type of rays. System model and specification of model environment will be explain in section III. In section IV, the analysis result of the channel measurement based on RT analysis will be exposed. Finally, conclusions are drawn in section V.

II. Propagation Mechanisms

Path loss is a measure of attenuation based only on the distance to the transmitter, as basic free space model only valid in far-field. Path loss models typically define a “close in” point d_0 and reference other points from there (1), also for log-distance generalizes path loss to account for other