DESIGN OF THE POWER FEEDING SYSTEM FOR ELECTRIFIED RAILWAYS
CASE STUDY: PANADURA- VEYANGODA RAILWAY SECTOR

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Degree of Master of Science in Electrical Engineering

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

June 2018

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Dissertation submitted in partial fulfilment of the requirements
for the degree Master of Science in Electrical Engineering

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters under our supervision.

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Signature of the supervisor: Date:

Prof. J.R. Lucas

ABSTRACT

In railway systems, electrical traction is more efficient, comfortable and more economical than diesel traction. Since the railway transportation is a major public transportation means in Sri Lanka, having an efficient and reliable electrified railway transportation system will increase the capacity of railway transportation and attract more passengers daily receiving the service.

This research is based on the proposed Panadura – Veyangoda railway electrification project. It is of vital importance to identify the required maximum power of the predicted system at the peak hours prior to designing the traction system. MATLAB Simulink software has been applied for the modelling the speed, power and distance of the train movement between stations with respect to time. Using the simulation results obtained from MATLAB Simulink model, a load flow study for the total train movements between Panadura station to Veyangoda station at peak hour is carried out in DIgSILENT Power Factory software to obtain the maximum power required for each traction substation.

Finally, the traction substation components are sized and layout of the system and earth grid arrangement is presented for Ratmalana traction substation as a case in point.

This software models can be applied for any other railway electrification systems to be predicted by modifying and changing their parameters accordingly.

Key words: Railway electrification, traction power, load flow, Scott-T transformer, MATLAB, DIgSILENT Power Factory

DEDICATION

I dedicate my M.Sc. research dissertation to my beloved parents for their guidance given throughout my life.

ACKNOWLEDGEMENT

First and foremost, I would like to pay my sincere gratitude to my project supervisors Prof. Rohan Lucas, Dr. Lidula. Widanagama Arachchige and Dr. Tilak Siyambalapitiya for their continuous guidance and support throughout the research to develop the result in to a fruitful outcome.

Secondly I would like to thank the postgraduate research coordinator of department, Dr. Upuli Jayatunga and Dr. Darshana Prasad for the supervision and management of research evaluation. I would like to a pay my sincerest appreciation towards the academic staff of Department of Electrical Engineering for their valuable feedback and constructive comments during the progress reviews.

I would like to sincerely thank The Chartered Institute of Logistics and Transport Sri Lanka (CILTSL) for awarding me the John Diandas Scholarship 2015/2016 for postgraduate research on transport in Sri Lanka. I specially acknowledge the Eng. (Ms.) Namalie Siyambalapitiya, Director Planning at Road Development Authority for her support. I pay my special gratitude to Dr. Wijekoon Banda, the Chief Engineer in Ceylon Electricity Board, Eng. Rienzie Fernando, The Managing Director of Amithi Power Consultants (Pvt) Ltd, Eng. Palitha Samarasinghe, Project Director - Colombo Suburban Railway Project (Railway Electrification Project funded by ADB), Eng. Keerthi Hewavithana, Deputy Chief Engineer at Sri Lanka Railway and other professionals from Sri Lanka Railway for providing continuous support to get required details for the project.

I would like to thank Eng. Andrea Mariscotti, Technical Director at ASTM, Eng. Yosef Tsegaye, Quality Assurance Team Leader at Ethiopia Railway Corporation for sharing their valuable knowledge related to railway electrification with me.

Finally, I wish to thank all of my friends and family for their persistent support during my dissertation work.

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LIST OF ABBREVIATIONS

AC- Alternative Current systems

CMR- Colombo Metropolitan Region

CEB-Ceylon Electricity Board

CoMTrans- Urban Transport System Development Project for Colombo Metropolitan Region and Suburb

DC -Direct Current

EMU -Electrical Multiple Unit

ETAP-Electrical Transient Analyzer Program

IGBT- Insulated Gate Bipolar Transistor

MFT -Medium Frequency Transformer

PCC - Point of Common Coupling

PEBB- Power Electronic Building Blocks

PPTA- Project Preparatory Technical Assistance

STRADA -System for Traffic Demand Analysis

SLR - Sri Lanka Railway