ACOUSTIC DESIGN OPTIMIZATION OF CLOSE-FITTING ENCLOSURE USING GENETIC ALGORITHM TOOL FOR DIESEL POWER GENERATOR SOUNDPROOFING APPLICATION

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Dissertation submitted in partial fulfillment of the requirements for the degree

Master of Science

Msc in Industrial Automation

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

May 2015

DECLARATION OF THE CANDIDATE AND SUPERVISOR

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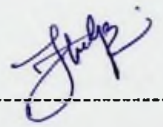

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ABSTRACT

Reciprocating engine power generator sets produce uncomfortably loud noise when it is in operation. Installation of Power Generator (PG) shall comply with local noise regulations. Further price, space and weight ensure a commercially appealing product in PG market. However in Sri Lanka most of the locally fabricated soundproof PGs has failed to meet SPL regulations even though it is in reasonable low price compared with imported soundproof PG. Open discussion about this problem with the local PG suppliers revealed that, absence of simple and fast acoustic enclosure design procedure customized with the SPL spectrum of open PG and the customer requirement of space, weight and cost has created this problem.

Close-fitting enclosure fabricated with sheet metal enclosure face insulated with sound absorption materials is method of Passive Noise Controlling (PNC) used in PG soundproofing. SPL model of soundproof PG was developed considering Insertion Loss (IL) of the enclosure and SPL spectrum of the open PG. The model was constrained for customer required SPL, cost and weigh. Effective deign variables of the model were identified and developed an optimization code for selecting optimum minimum values for the identified variables using Genetic Algorithm (GA) optimization tool in MATLAB. Optimization were converted to user friendly deign application through a Graphical User Interface (GUI).

Validity of the developed design methodology was done by comparing the model predicted data with manufacturer given data for selected set of "Cummins" power generators. After that design variables were predicted for open type standby power 22kVA "Cummins" PG with 75% load at 3m distance and the acoustic enclosure for the model was fabricated accordingly. SPL measurement of fabricated enclosure realized the developed methodology is substantially accurate and result can be used for the preliminary design of the enclosure. Accuracy of deign can be developed further by considering the effect of noise leak through opening and the effect of sound attenuator.

DEDICATION

To my family who proved lovely relationships beyond the logic

ACKNOWLEDGEMENT

I would like to gratefully acknowledge research supervisor Dr. D.P. Chandima, Senior Lecturer, Department of Electrical Engineering, University of Moratuwa for his dedication, inspiration and great effort throughout the research. Also I would like to thank senior lecturers of Department of Electrical Engineering, University of Moratuwa for their valuable feedbacks and advices during progress reviews that directed my research towards a realistic end.

I gratefully thank Eng. P.K. Chadrasekars, Chef Engineer, Power Plant section, Ceylon Electricity Board for providing entire resource for the research.

I am thankful Power Generator engineering team of the Trade Promoters (Pvt) Ltd, Hayleys Industrial Solutions (Pvt) Ltd and Metropolitan Engineering (Pvt) Ltd. for their immense support on problem oriented survey and providing manufacturer data of commercially available Power Generators.

Last but not least, I am grateful to Department of Electrical Engineering, University of Moratuwa for providing me the opportunity to read MSc in Industrial Automation successfully.

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LIST OF ABBREVIATIONS

Abbreviation	Description
SIL	Sound Insertion Loss
dB	Decibel
OSHA	Occupational Safety and Health Administration
dB(A)	A weighted Decibel
ANC	Active Noise Control
PNC	Passive Noise Control
TL	Transmission Loss
IL	Insertion Loss
GA	Genetic Algorithm
GUI	Graphical User Interface

LIST OF APPENDIXES