ABSTRACT

Act of drawing or state of being drawn, propulsion of vehicle is called the traction and the system of traction involving the use of electricity is called the electric traction system. Electric traction systems are the most widely used because of their qualities like high efficiency, heavy ridership and fast transportation. The introduction of self commuting solid state devices has boosted the application of ac motor drives in electric traction systems. The variable frequency induction motor drives used in AC traction system consist of uncontrolled ac-dc converters and voltage source inverters feeding the induction motor. Such converters induce power quality issues in the power distribution system feeding the traction system such as injecting harmonics which leads to voltage fluctuation, reactive power and low power factor issues.

Different international organizations have given guidelines through various standards like IEEE-519, IEC 61000-3-2, etc to inflict limits on the levels of harmonic current emissions. This has lead to novel research in suggesting and developing different ways and means for reducing these harmonic currents and to improve the power quality. Various circuit topologies have been reported in the literature for converter inverter designing for feeding traction motor drive.

This work presents the performance analysis of electric traction motor drive consisting of an AC-DC converter fed vector controlled induction motor drive. The converter provides the constant dc link, keeps the input power factor close to unity and also reduces the THD of AC mains current. Modelling and simulated results of the converter fed induction motor drive are presented to demonstrate the features of electric traction drive. The necessary modelling and simulations are done in MATLAB Simulink.

ACKNOWLEDGEMENT

I take this opportunity to express my sincere gratitude to all those who have been instrumental in the successful completion of this project. One cannot even imagine the power of the force that guides us all and neither can we succeed without acknowledging it. My deepest gratitude to **Almighty God** for holding my hands and guiding me throughout my lives.

I would like to thank my beloved parents, who always give me strong inspirations, moral supports, and helpful suggestions. Without them, my study career would never have begun. It is only because of them, my life has always been full of abundant blessing.

Dr. Rachana Garg, Associate Professor, Dept. Of Electrical Engineering, Delhi Technological University, my project guide, has guided me for the successful completion of this project. It is worth mentioning that she always provided the necessary guidance and support. I sincerely thank her for her wholehearted guidance.

I would like to express my sincere thanks to **Prof. Parmod Kumar**, formerly-HOD, Electrical Engineering Department, Delhi Technological University for his help and guidance. I would like to thanks Mrs Priya Mahajan, Assistant Professor for her suggestions and help.

I am grateful for the help and cooperation of HOD EED, **Prof. Madhusudan Singh**, Head Department of Electrical Engineering, Delhi Technological University, for providing the necessary lab facilities and cooperation. And I wish to thank all faculty members whoever helped to finish my project in all aspects. To all the named and many unnamed, my sincere thanks. Surely it is Almighty's grace to get things done fruitfully.

NIKITA GUPTA

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LIST OF SYMBOLS

Symbols	**Description**
d^s-q^s	Stationary reference frame direct and quadrature axis
d^e-q^e	Synchronously rotating reference frame direct and quadrature axis
i_{qs}	q^e-axis stator current
i_{qr}	q^e-axis rotor current
i_{dr}	d^e-axis rotor current
i_{ds}	d^e-axis stator current
i_{qs}	q^e-axis stator current
L_m	Magnetizing inductance
L_{ls}	Stator leakage inductance
L_{lr}	Rotor leakage inductance
v_{qs}	q^e -axis stator voltage
v_{ds}	d^e -axis stator voltage
v_{qr}	q^e-axis rotor voltage
v_{dr}	d^e-axis rotor voltage
R_s	Stator resistance
R_r	Rotor resistance
L_s	Stator inductance
L_r	Rotor inductance
ω_e	Stator or line frequency
ω_r	Rotor electrical speed
ω_{sl}	Slip frequency
s	Laplace operator
p	Number of pole
θ_e	Angle of synchronously rotating frame
θ_r	Rotor angle
θ_{sl}	Slip angle
v_{qs}^s	q^s-axis stator voltage
v_{ds}^s	d^s-axis stator voltage
i_{qs}^s	q^s-axis stator current
i_{ds}^s	d^s-axis stator current
K_s	Slip gain
Q	Reactive power
Q*	Reactive power reference
i_a*, i_b*, and i_c*	Stator current reference
i_{qs}*	Stator quadrature-axis reference current
i_{ds}*	Stator direct-axis reference current
$\vert \psi_r \vert$*	Sotor flux reference input
T_e*	Torque reference
$\vert \psi_r \vert_{est}$	Estimated rotor flux linkage