Design of a Medium-Voltage Three-Phase AC Electric Drive Using a Perfect Harmony Inverter

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***Abstract*—This thesis focuses on the design of a medium-voltage three-phase AC electric drive using the Perfect Harmony inverter. The author provides a comprehensive overview of medium voltage AC drives, their structures, and the Perfect Harmony inverter's features. The design includes the development of a six-pulse rectifier and H-bridge multi-level inverter, as well as the control algorithms for the inverter. The author conducted simulations on MATLAB and Simulink to validate the design. The results demonstrated the feasibility of the proposed design, but no field deployment or practical effectiveness was reported.**

***Index Terms*—Medium Voltage AC Drive, Perfect Harmony Inverter, Three-Phase Induction Motor, Control Strategy, Simulation, MATLAB**

I. Introduction

The report presents an in-depth study of medium voltage AC drives, their applications, and the design of a three-phase AC electric drive using the Perfect Harmony inverter. The author reviews the general principles and structures of medium voltage AC drives, focusing on the Perfect Harmony inverter's characteristics and its application in three-phase induction motors. The study aims to explore the feasibility of using the Perfect Harmony inverter in medium voltage AC drives for efficient and precise control of three-phase induction motors [1]. Published articles on the methods and subject of this project provide context for this English summary [9], [10]. Published books on the methods and subject of this project provide context for this English summary [11].

II. Methods

The author designed a six-pulse rectifier and H-bridge multi-level inverter for the Perfect Harmony inverter. The control algorithms for the inverter were developed, and the three-phase induction motor was modeled. Simulations were conducted on MATLAB and Simulink to validate the design. The simulations included the modeling of the six-pulse rectifier, the H-bridge multi-level inverter, and the control strategy based on rotor flux orientation. The author also derived and implemented the control algorithms for the inverter, ensuring the feasibility of the proposed design [1].

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III. Results

The simulations on MATLAB and Simulink were used to verify the design of the inverter and the control strategy. The results demonstrated the feasibility of the proposed design, showing that the inverter could effectively control the three-phase induction motor. However, no field deployment or practical effectiveness was reported. The simulations provided a basis for further development of the open-loop vector control system, but no specific performance metrics or test results were documented [1].

IV. Discussion

The author discusses the design of the inverter and the control strategy, highlighting the importance of the Perfect Harmony inverter in achieving efficient and precise control of three-phase induction motors. The simulations on MATLAB and Simulink provided a basis for further development of the open-loop vector control system. The author suggests that future work could focus on developing an open-loop vector control system and estimating motor speed without using an encoder. However, no specific performance metrics or test results were provided to support these suggestions [1].

V. Conclusion

The thesis concludes that the design of the medium-voltage three-phase AC electric drive using the Perfect Harmony inverter is feasible. The author suggests that future work could focus on developing an open-loop vector control system and estimating motor speed without using an encoder. The simulations on MATLAB and Simulink provided a basis for further development, but no field deployment or practical effectiveness was reported [1].

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