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Indirect Matrix Converter with Model Predictive Control for Optimize the System

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Key words: Model predictive control, indirect matrix converter, LSA, multiplication

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Abstract: In this study, the Indirect Matrix Converter (IMC) is used to provide output voltage which mutablein magnitudes and frequencies from AC power supply. It delivers sinusoidal current. In addition, IMC permitshigh dependability. However, the ratio of transfer voltage is less than one in IMC. To overcome this problem, model predictive control MPC is used to optimize the system. Also, MPC is better than least square approximation LSA because LSA have high mathematical multiplication problem. The simulation result is achieved by using MATLAB. From the results, the proposed MPC with IMC have power over the LSA.

INTRODUCTION

A matrix converter has the ability to convert the inputvoltage to AC voltage, the variable output voltage and output frequency can be controlled by suitable control techniques[1, 2]. The matrix converter can be classified into direct matrix converter DMC and indirect matrix converter IMC.The DMC is not appropriate for difference loads[3]. The IMC is better than DMC because the IMC supplies multiple loads with difference voltage in the same time[4, 5]. The rectifier and inverters stage have six bidirectional and six unidirectional switching, respectively[6-8]. The rectifier is used to generate current. The inverter is used to generate output voltages with variable amplitude and frequency. The current distortion is minimized by using the filter at the output of inverter and at output of rectifier[9, 10].

MATERIALS AND METHODS

Materials and proposed MPC-IMC: The proposed MPC with IMC is used to enhance the IMC performance as well as to optimize the system. The input current and output current will apply to MPC. The output of MPC is used to control of switching of the inverter for IMC.

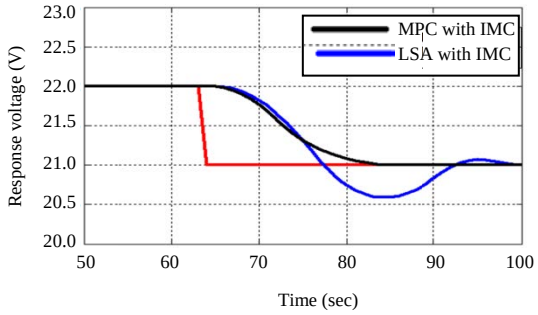

Fig. 1: The comparison between MPC and LSA

RESULTS AND DISCUSSION

MATLAB is used to generate the simulation results. The comparison results between MPC-IMC with LSA-IMC for current is shown in Fig. 1. From this figure, the system with MPC is fast response without undershoot as compare with LSA. The input current and input voltage to IMC based on MPC are presented in Fig. 2 and 3, respectively.

The output voltage and output current from IMC is synchronous and practically has no distortion as shown

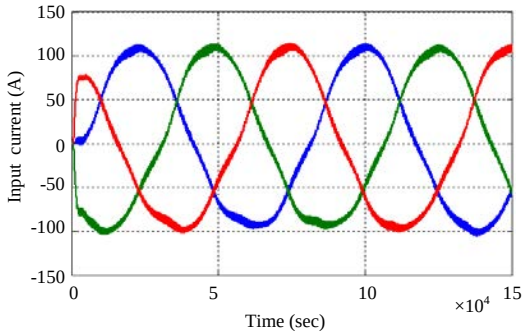

Fig. 2: Input current of IMC

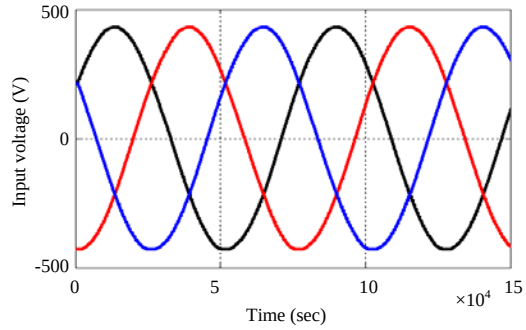

Fig. 3: Input voltage of IMC

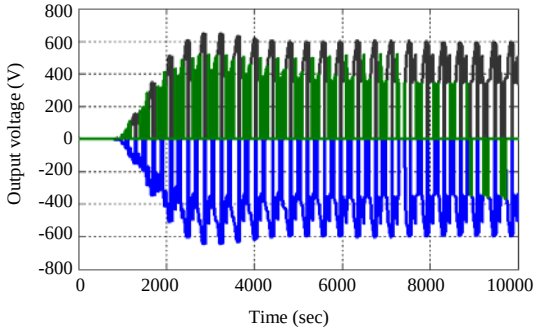

Fig. 4: Output voltage of IMC

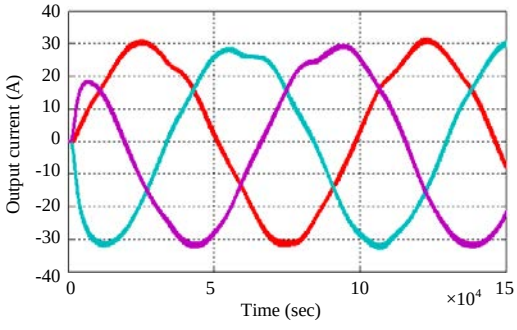

Fig. 5: Output current of IMC

in Fig. 4 and 5 correspondingly. The output voltage for phase A of IMC based on MPC is shown in Fig. 6.

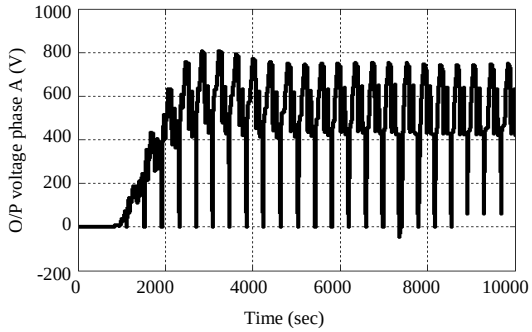

Fig. 6: Output voltage phase A

CONCLUSION

The results of the suggested MPC-IMC showed the toughness and the ability of MPC to enhance the system and to improve the IMC performance. In addition, the comparison results of MPC and LSA demonstrate that the complicated of LSA with the drawbacks of IMC is solved by using MPC. Therefore, the system with MPC is more robustness and fast response with simple construction as compared with another controller.

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