

APPENDIX B

THE PMBLDC MOTOR

In this dissertation, the proposed PLL adjustable speed controller is designed for PMBLDC motors. In order to validate the feasibility and effectiveness of the proposed adjustable speed drive, an industrial blower is chosen as the test load. Also comparison of the energy saving effects for the industrial blower system driven by the proposed adjustable speed controller and a PMBLDC motor or a blower system driven by a three-phase induction motor are made. For accomplish a total system solution, a PMBLDC motor with 6-poles, Y connected winding, 18-slots and a current rating of 3.5A and with trapezoidal phase voltage peak of 150V at 1100rpm rating is designed.

The corresponding geometric parameters of the self-designed PMBLDC are listed in Table B.1, also the 2D geometry is shown in Fig. B.1. In Fig. B.1 conventional circular stator and rotor shape are adopted, there are 6 poles and 18 slots. In order to achieve trapezoidal back emfs, the rectangular high energy product magnets, NdFeB as shown in Fig. B.2, are selected to be placed inside the rotor core of the proposed PMBLDC and have been magnetized in radial direction. Fig. B.3 shows the single layer concentric winding diagram of the stator in order to induce three-phase trapezoidal back emfs. With the stator windings being open circuited, the 2D flux distribution due to the magnets can be obtained by using a commercial finite element software, namely MAGSOFT FLUX2D. The

Table B.1 Geometric Parameters of the Self-Designed PMBLDC Motor

PARAMETERS	DESCRIPTION
stator outer diameter	122mm
stator inner diameter	70mm
rotor outer diameter	68mm
airgap length	1mm
shaft diameter	25mm
stack length	50mm
stator and rotor core	silicon steel-S50
magnet	NdFeB($B_r=1.12T$)

corresponding flux distribution is shown in Fig. B.4. The picture of the prototype motor components and the back emfs of the PMBLDC motor are also shown in Fig. B.5 and Fig. B.6 respectively for reference.

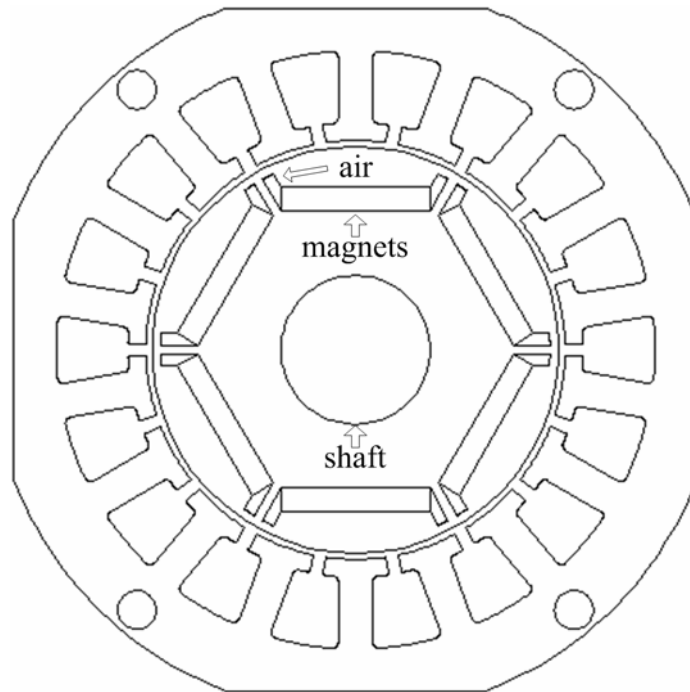


Fig. B.1 2D geometry of the self-designed PMBLDC motor.

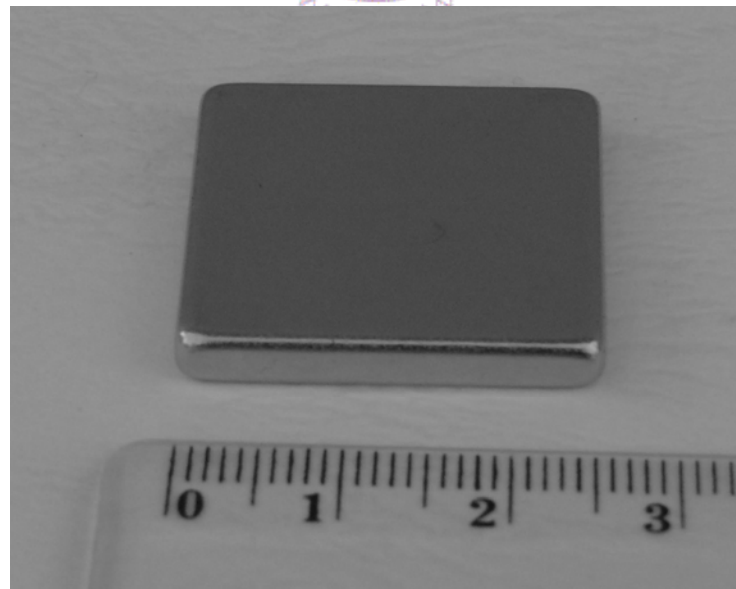


Fig. B.2 The picture of the NdFeB magnet of the PMBLDC motor.

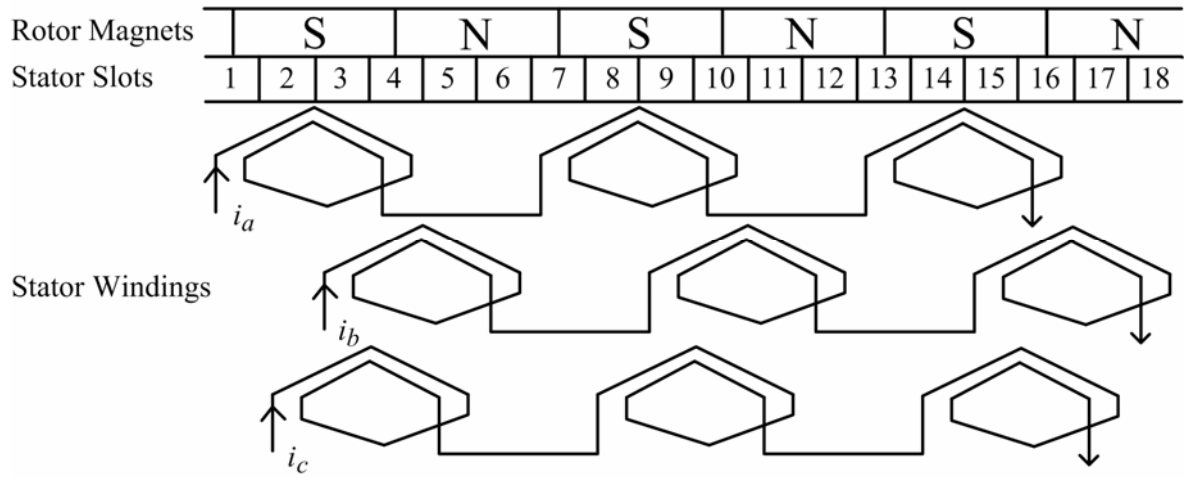


Fig. B.3 Three-phase winding diagram of the stator of the PMBLDC motor.

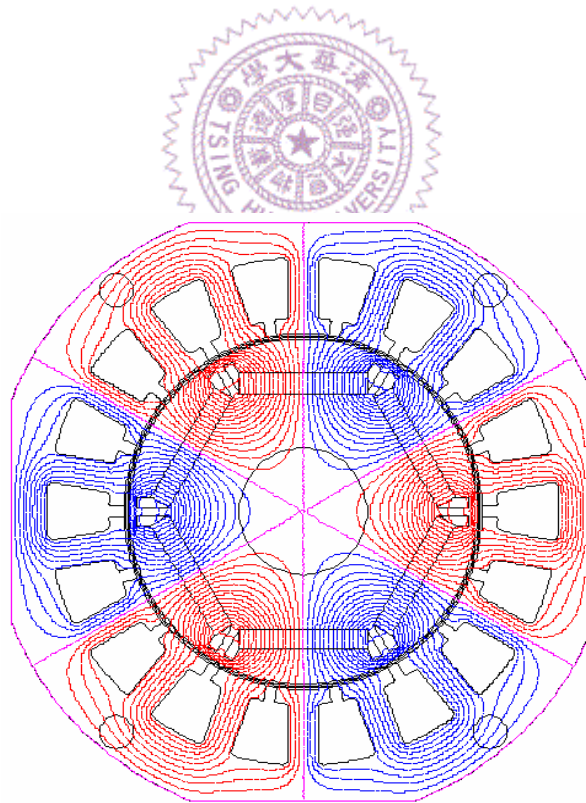


Fig. B.4 The flux distribution of the PMBLDC motor with stator circuit being opened.

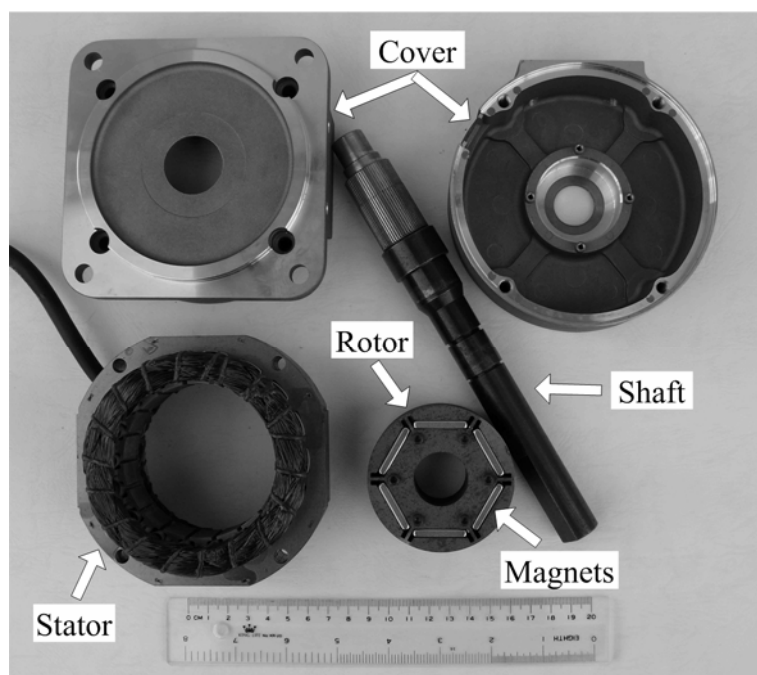


Fig. B.5 The picture of the components of the PMBLDC motor.

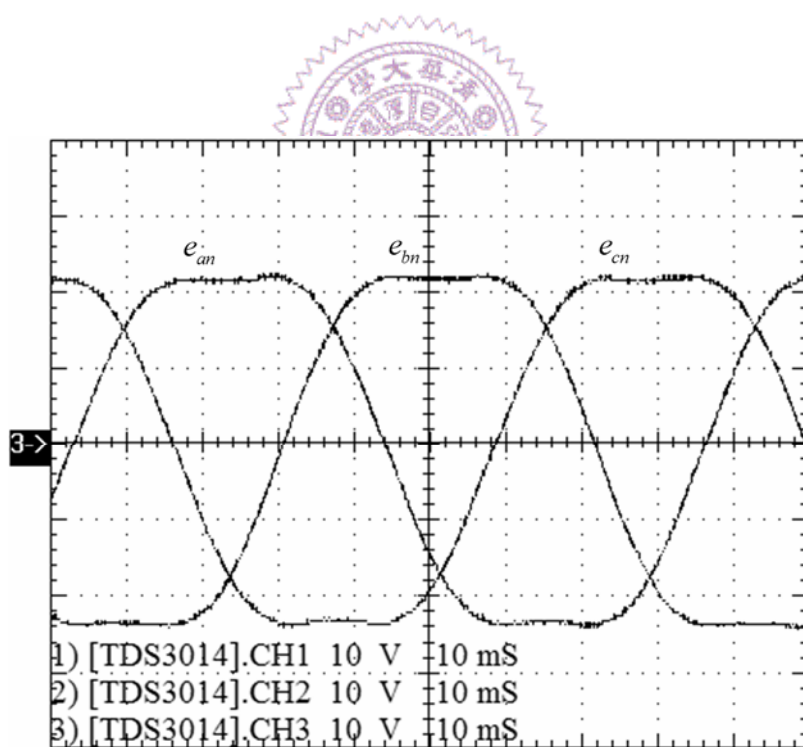


Fig. B.6 The measured three-phase back emfs of the PMBLDC motor.