

# Power Factor Correction of Single-Phase Induction Motor Using Magnetic Energy Recovery Switch

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Magnetic energy recovery switch (MERS) has a function of automatic power factor correction regardless of an impedance of ac circuit by simple circuit and simple control. MERS itself generates voltage and compensates the reactance voltage and additional DC power supply is not required. MERS is applied to a single-phase which has a low power factor and a changing impedance depending on the load factor. And two control methods of MERS for power factor correction is proposed.

Fig. 1 shows an experimental configuration. The MERS is inserted in series between ac power source and the single-phase induction motor. Fig. 2 shows a phase shifting gate control circuit. RC circuit generates the sinusoidal signal of about  $\pi/2$  advanced from power supply voltage. It is necessary to advance the phase of S1 and S3 by  $\pi/2$  from  $v_1$  to realize automatic power factor improvement<sup>(1)</sup>. The circuit configuration is simple because it is not a feedback control according to the load impedance. Fig. 3 shows a block diagram of current feedback PWM control. The current is controlled by PI control.

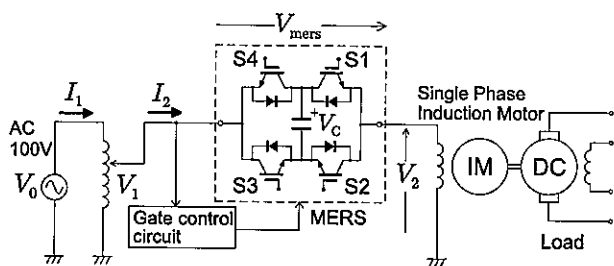


Fig. 1. Experimental circuit diagram

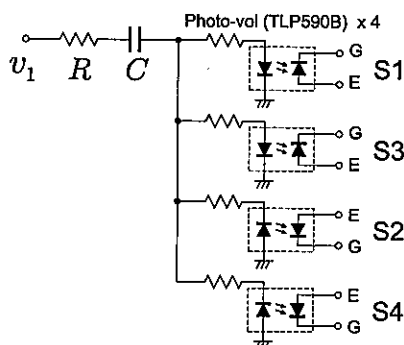


Fig. 2. Configuration of phase shifting gate control circuit

Fig. 4 shows a comparison of measured power factors. The power factor with simple phase shifting control are maintained within the range from 0.9 to 1.0. It doesn't change greatly according

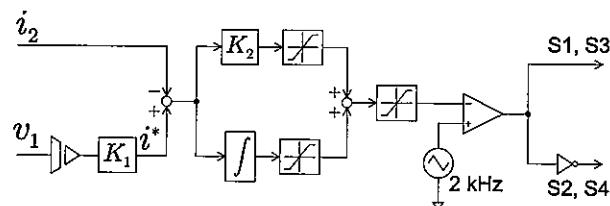


Fig. 3. Block diagram of current feedback PWM control

to the load. However, it slightly decreases at light load because the current waveform is distorted and higher harmonics is contained. While, by using PWM control, the harmonics current was compensated and the current waveforms becomes sinusoidal. Therefore the power factor is always maintained to be unity. Also, it was experimentally confirmed that efficiency and characteristics of a induction motor is not change in the power factor improvement by MERS.

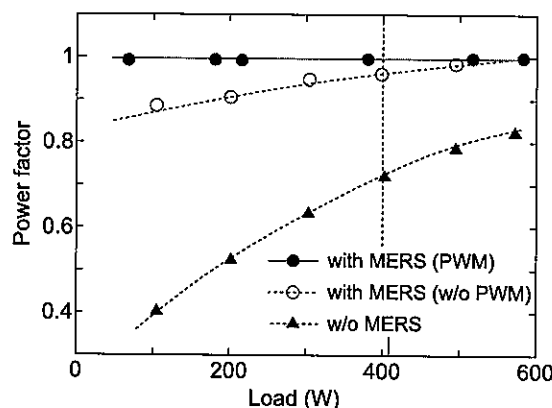


Fig. 4. Comparison of power factor with MERS and without MERS

These experimental results demonstrate that MERS with the phase shifting control can improve the power factor automatically regardless of the load factor. And it has an enough effect of improving a power factor at low-cost. The sinusoidal current is generated by PWM control and the power factor improved more efficiently, however, circuit composition becomes complicated.

Moreover, power supply capacity and loss of electric wire decreased was proved by improving power factor of electric appliance with a single-phase induction motor.

## References

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