

Full-Bridge Chopper for Driving Two DC Motors with Reduced Counts of Switching Devices

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1. Introduction

The authors have examined chopper circuits for driving two DC motors in four-quadrant operation at once, which is applied to an electric wheelchair system. This paper shows an advanced full-bridge DC chopper, and the feasibility is proven by computer simulation.

2. Power Supply and Full-Bridge Chopper

The power supply of the system is a PEM fuel cell, and the basic specification is 200W-24V.

The two DC motors are driven by the full-bridge chopper shown in Fig. 1, which has the reduced number of switching devices to six. PWM switching frequency of Q_1 , Q_2 , Q_5 and Q_6 is 20kHz, and that of Q_3 and Q_4 is 2kHz. Notable point of this configuration is the DC bus voltage boosted up by the center common leg. Also, changing duty ratio of Q_1 , Q_2 , Q_5 and Q_6 allows the adjustment of the output voltage.

3. Drive of Two DC Motors

Figure 2 (a) and (b) illustrate the current path of the proposed chopper when the wheelchair operates in a forward mode and a pivot mode (right turn). In the figures, the boost up operation is also shown.

Figure 3 shows the simulation results of the motor drive; (a) is a case of the forward mode and (b) is for the pivot mode. As a result, it can be seen that the voltages of right-hand side motor (V_R) and the left one (V_L) operate the chopping. The peak voltages of them reach 48V, which is obtained by the boost up operation. When the pivot mode is performed, V_R reaches minus 48V, so the two motors rotate in contrary directions with each other.

4. Conclusion

It has been cleared that the proposed full-bridge chopper for driving two DC motors has superior performance with reduced counts of the switching devices. Therefore, it can be applied not only the electric wheelchair but also other systems.

References

[1] C. Anyapo, K. Saito, and T. Noguchi: Niigata Branch of IEEJ, IV-6, p.56, 2006.

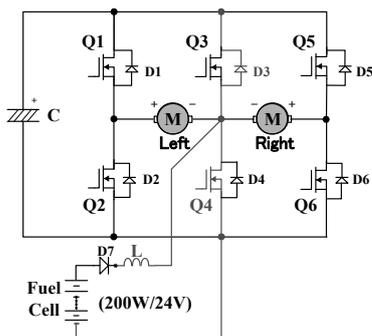
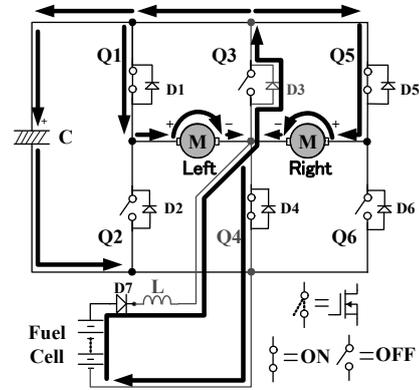
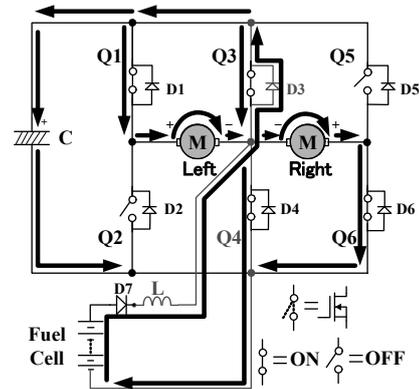


Fig. 1. Full-bridge chopper for two DC motors.

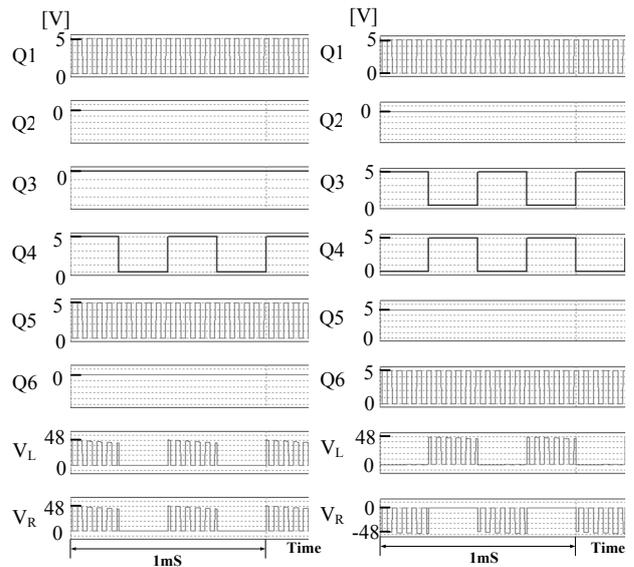


(a) Forward mode.



(b) Pivot mode.

Fig. 2. Operation of full-bridge chopper.



(a) Forward mode. (b) Pivot mode.

Fig. 3. Switching states and motor voltages.