Single Inductor Dual Buck Full-Bridge Inverter

Abstract

The shoot-through problem is a major killer of the reliability. It needs to set dead time to avoid the problem, but the dead-time effect will cause the distortion of output. During the dead time, the inductor current flows through the body diode, which has long reverse recovery time and great loss.

Therefore, except for the bridge-type inverter, the dual-buck type inverter is proposed along with lots of research and development in recent years. The basic unit of dual-buck-type inverter is unidirectional buck circuit; thus, there is no shoot-through problem in the inverter and the freewheeling current flows through the independent diodes instead of body diodes of the switches, which is conducive to reducing the reverse recovery loss, increasing the switching frequency and using the super-junction power metal–oxide–v-semiconductor field-effect transistor with low on-resistance. In addition, it is easy to have the series and parallel combinations for the inverter and construct a three-phase system.
**Existing system**

The DBHBI without circulation current was introduced, which contributed to realizing high reliability, high frequency, and high efficiency. The half-bridge input mode, which leads to a low input-voltage utilization rate and high voltage stress.

**Proposed system**

This paper proposed a new single inductor dual buck full-bridge inverter, which works without circulation current and adopts sinusoidal pulse width modulation (SPWM) control method. The schematic of SIDBFBI proposed, which consists of voltage commutation bridge and bidirectional current-mode high-frequency chopper circuit. The voltage commutation bridge works at low frequency, just changing the polarity of the input voltage $U_i$, and the output voltage $uA$ is power-frequency square wave. Then, the bidirectional current mode high-frequency chopper circuit with no shoot-through problem carries out the high-frequency chopping for $uA$, outputting single polar high-frequency modulation wave $uC$, which is changed into the output voltage $u_o$ by filtering.
Advantages

- It retains the advantages of a dual buck inverter as follows: high conversion efficiency, no reverse recovery of body diode. In addition, the switches of the commutation bridge work at power frequency; thus, the effect of shoot-through problem can be ignored.

- Compared with other dual buck inverters, the inverter has only one filter inductor; thus, the volume and weight of the system are observably decreased, and the integration is more improved.

- Compared with the half-bridge style inverter, the voltage dividing capacitor is not needed at the dc side, and the voltage stress of power devices can be reduced at the same output voltage, which is suitable for the high-voltage and high-power occasions.
Applications

- Aerospace.
- New energy power generation.
- Smart power grids.
- High voltage and high-power converting fields.

Block diagram

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INPUT DC SUPPLY —> FULL BRIDGE INVERTER —> BI-DIRECTIONAL CURRENT-MODE HIGH-FREQUENCY CHOPPER CIRCUIT —> LOAD

12V DC —> DRIVER CIRCUIT

5V DC —> PIC CONTROLLER WITH BUFFER
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Tools and software

- MPLAB – microcontroller programming.
- ORCAD – circuit layout.
- MATLAB/Simulink – Simulation.