Dual Active Bridge (DAB) DC-DC Converter

This repository contains a MATLAB/Simulink model of a Dual Active Bridge (DAB) converter. The DAB is a bidirectional DC-DC converter featuring high power density, galvanic isolation, and soft-switching capabilities, making it ideal for electric vehicle (EV) chargers and renewable energy systems.

Overview

The Dual Active Bridge consists of two full-bridge inverters connected via a high-frequency isolation transformer. Power flow is controlled by adjusting the phase shift between the primary and secondary bridge gate signals.

Key Features:

- Topology: Full-bridge (Primary) + Full-bridge (Secondary).
- Isolation: High-frequency transformer integration.
- Control Strategy: Single Phase Shift (SPS) modulation.
- Closed-Loop Control: PI controller for output voltage regulation.

Circuit Components

Based on the model provided, the system includes:

1. DC Input Source: Primary side supply.
2. Primary H-Bridge: Four IGBT/MOSFET switches (controlled by signals [a] through [d]).
3. HF Transformer: Provides voltage scaling and galvanic isolation.
4. Secondary H-Bridge: Active rectification on the output side.
5. Output Filter: Inductor-capacitor (LC) filter to minimize ripple.
6. Control Block: * PI Controller: Compares output voltage V_o against an 800V reference.
    - MATLAB Function Block: Generates the PWM sequences with phase-shift logic.
    - Switching Frequency: Set at 250 kHz (250×10^3).

How to Use

Prerequisites

- MATLAB (R2020a or newer recommended)
- Simulink
- Simscape Electrical (Specialized Power Systems)

Running the Simulation

1. Clone the repository:
2. Open DAB_model.slx in Simulink.
3. Check the Discrete Powergui block (set to 1 e-8 s for high-frequency accuracy).
4. Press Run and observe the output voltage V out and transformer currents on the Scopes.

Results

The current configuration aims for a stable 800V DC output.

- Signal [a, b]: Primary bridge PWM.
- Signal [c, d]: Secondary bridge PWM (Phase-shifted).