

# System Overview

**Converter Topology:** 9th-order interleaved bridgeless SEPIC (Single-Ended Primary-Inductor Converter) with Power Factor Correction (PFC) capability

**System Order:** 9th-order system comprising 6 inductors and 3 capacitors

## State Vector Definition

$$\mathbf{x} = [i_{L1}, i_{L2}, i_{L3}, i_{L4}, i_{L5}, i_{L6}, v_{C1}, v_{C3}, v_{C0}]^T$$

**Where:**

- $i_{L1}, i_{L2}$ : Phase 2 and Phase 1 input inductors (positive cycle)
- $i_{L3}, i_{L4}$ : Phase 1 and Phase 2 input inductors (negative cycle - inactive for  $V_{in} > 0$ )
- $i_{L5}, i_{L6}$ : Phase 1 and Phase 2 output inductors
- $v_{C1}, v_{C3}$ : Phase 1 and Phase 2 coupling capacitors
- $v_{C0}$ : Output (bus) capacitor voltage

## Four Switching Topologies

### Topology 11 (S1 ON, S2 ON)

Both phases store energy from AC source. Output bus isolated.

### Topology 10 (S1 ON, S2 OFF)

Phase 1 stores energy. Phase 2 transfers to output.

### Topology 01 (S1 OFF, S2 ON)

Phase 2 stores energy. Phase 1 transfers to output.

### Topology 00 (S1 OFF, S2 OFF)

Both phases transfer energy to output simultaneously.

**Note:** This analysis focuses on the positive half-cycle ( $V_{in} > 0$ ). Each topology has 9 differential equations, resulting in a complete set of 36 equations (4 topologies  $\times$  9 states).