

# Critical Insight 1: Input Inductors Direct Charging

## L1 and L2 charge DIRECTLY from $V_{in}$ when their switches are ON

- Path:  $V_{in} \rightarrow L1/L2 \rightarrow$  Diode (D1/D3)  $\rightarrow$  Switch (S1/S2)  $\rightarrow$  Ground
- NO capacitor voltage in KVL loop
- Equation form:  $diL/dt = V_{in} / L$  (pure source voltage)

$V_{in}(+) \rightarrow L2 \rightarrow D1$  (forward,  $\sim 0V$ )  $\rightarrow S1$  (closed,  $\sim 0V$ )  $\rightarrow GND$

### ✗ INCORRECT

Common misconception in Topology 11:

$$diL1/dt = (V_{in} - vC3) / L1$$

*Wrong because: Assumes C3 is in series with L1 in KVL loop*

### ✓ CORRECT

Actual equation in Topology 11:

$$diL1/dt = V_{in} / L1$$

*Correct because: C3 contributes CURRENT (KCL), not voltage (KVL) to L1's charging path*

**Key Understanding:** At the junction of L1 and C3, current splits.  $iL1$  flows through D3  $\rightarrow$  S2 to ground, while C3 provides/receives current based on KCL (see  $dvC3/dt$  equation). The capacitors stage energy but don't affect input inductor voltage equations during storage mode.