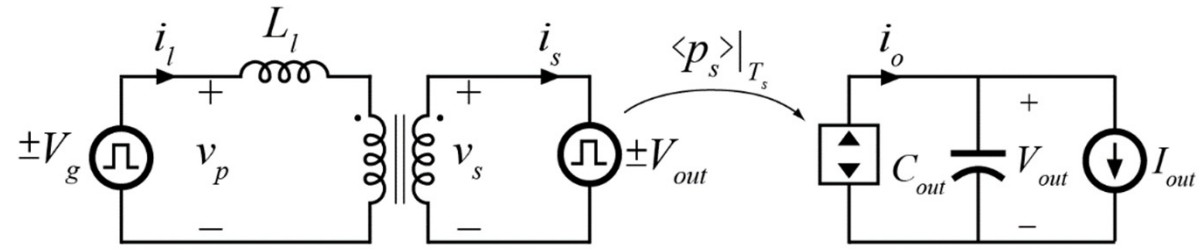
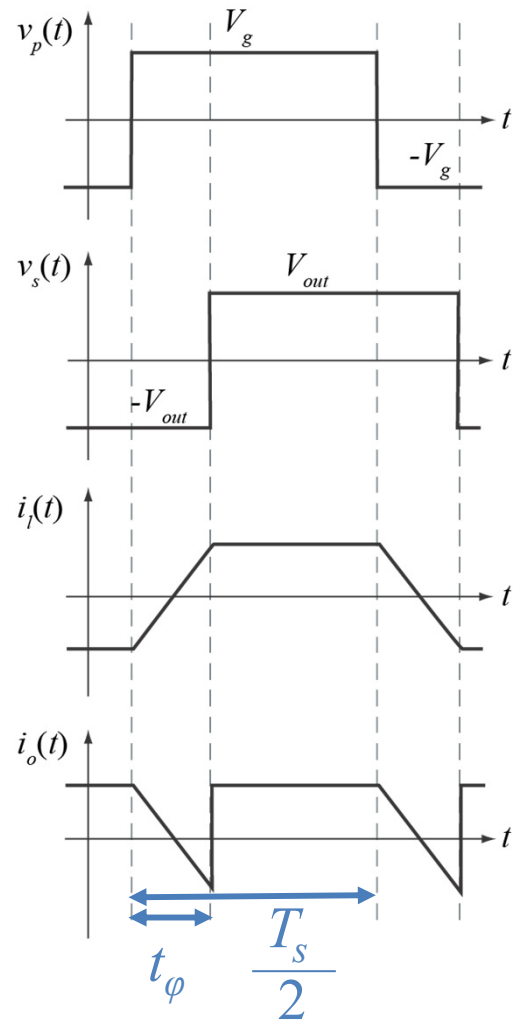


Linear Averaged Modeling of DAB



$$\langle i_o \rangle |_{T_s} = \frac{V_g}{n_t L_l T_s} (T_s t_\phi - 2t_\phi^2)$$

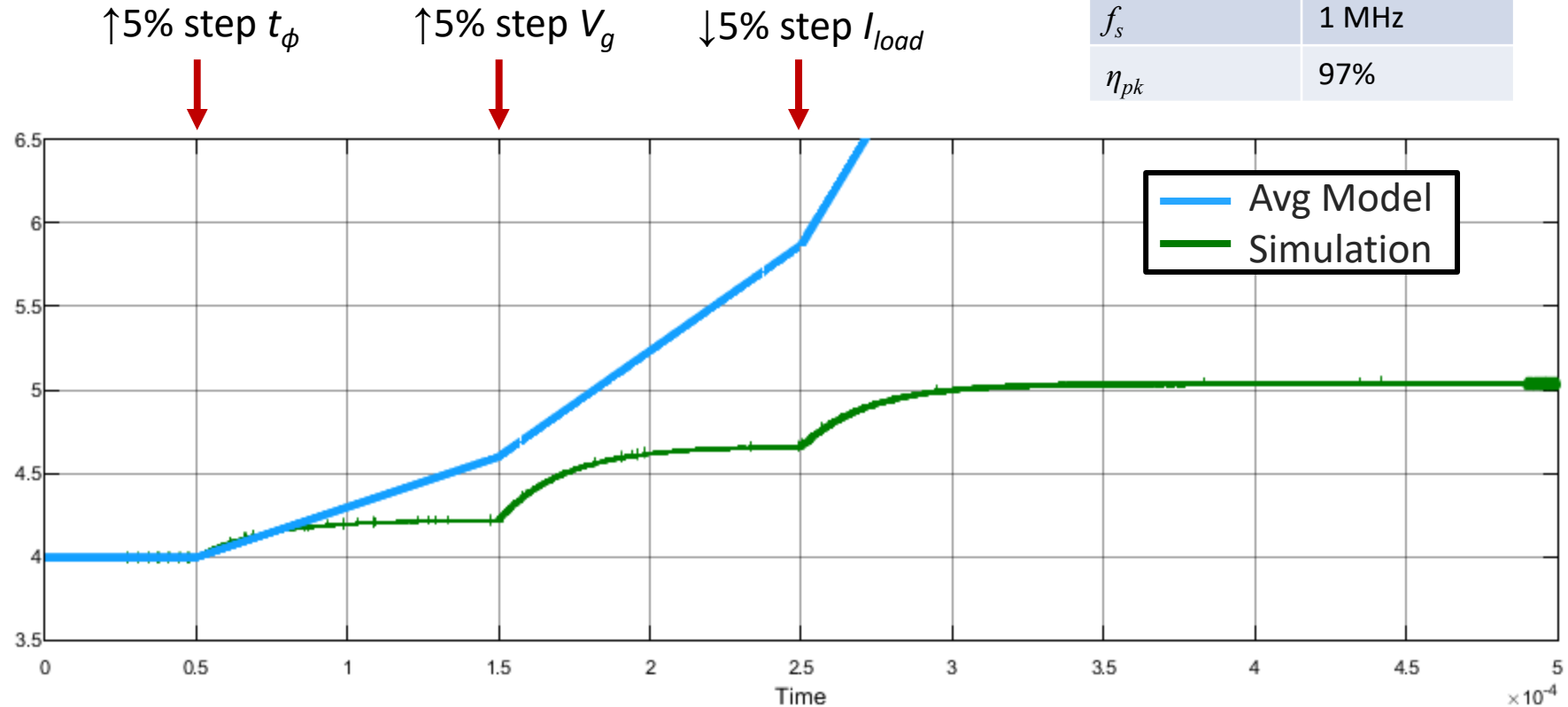
Average Model Transfer Functions

Converter Block Diagram

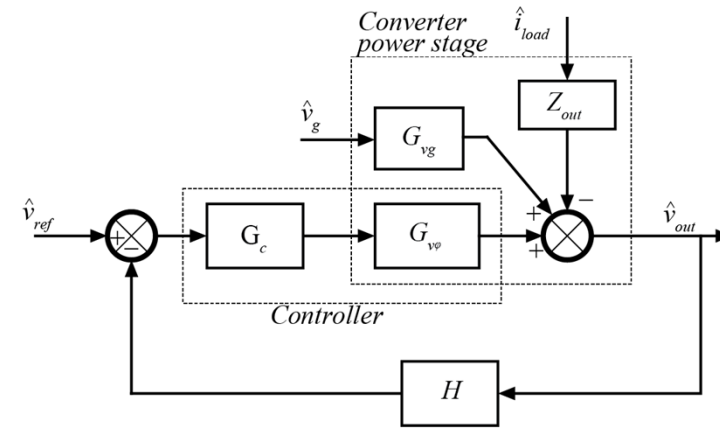
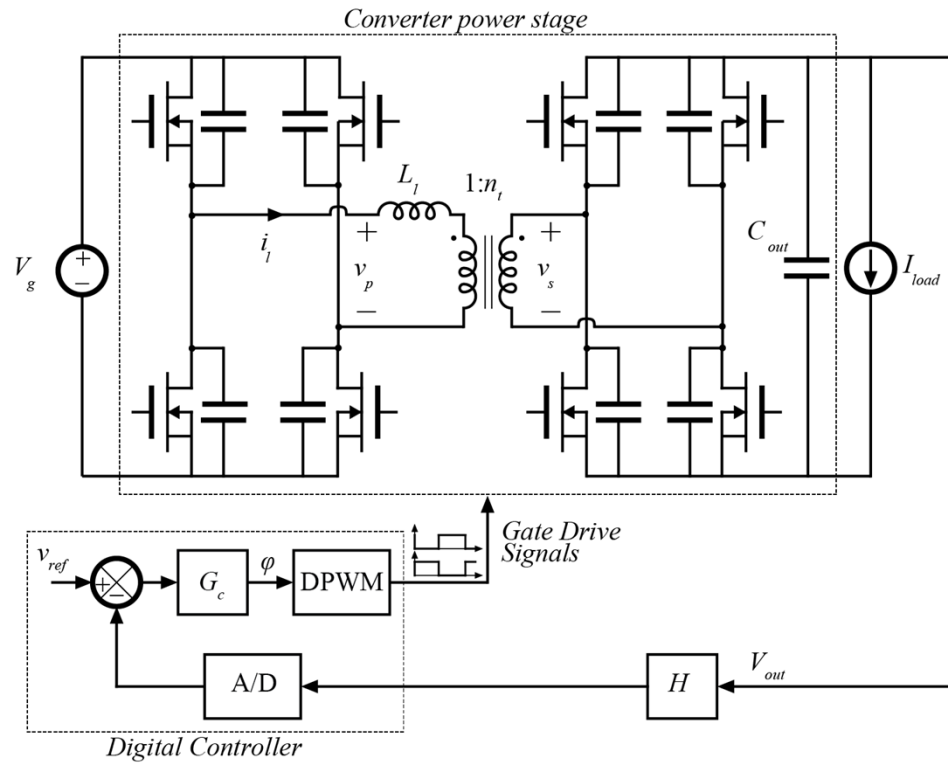
Digital Control Block Diagram

Model Validation

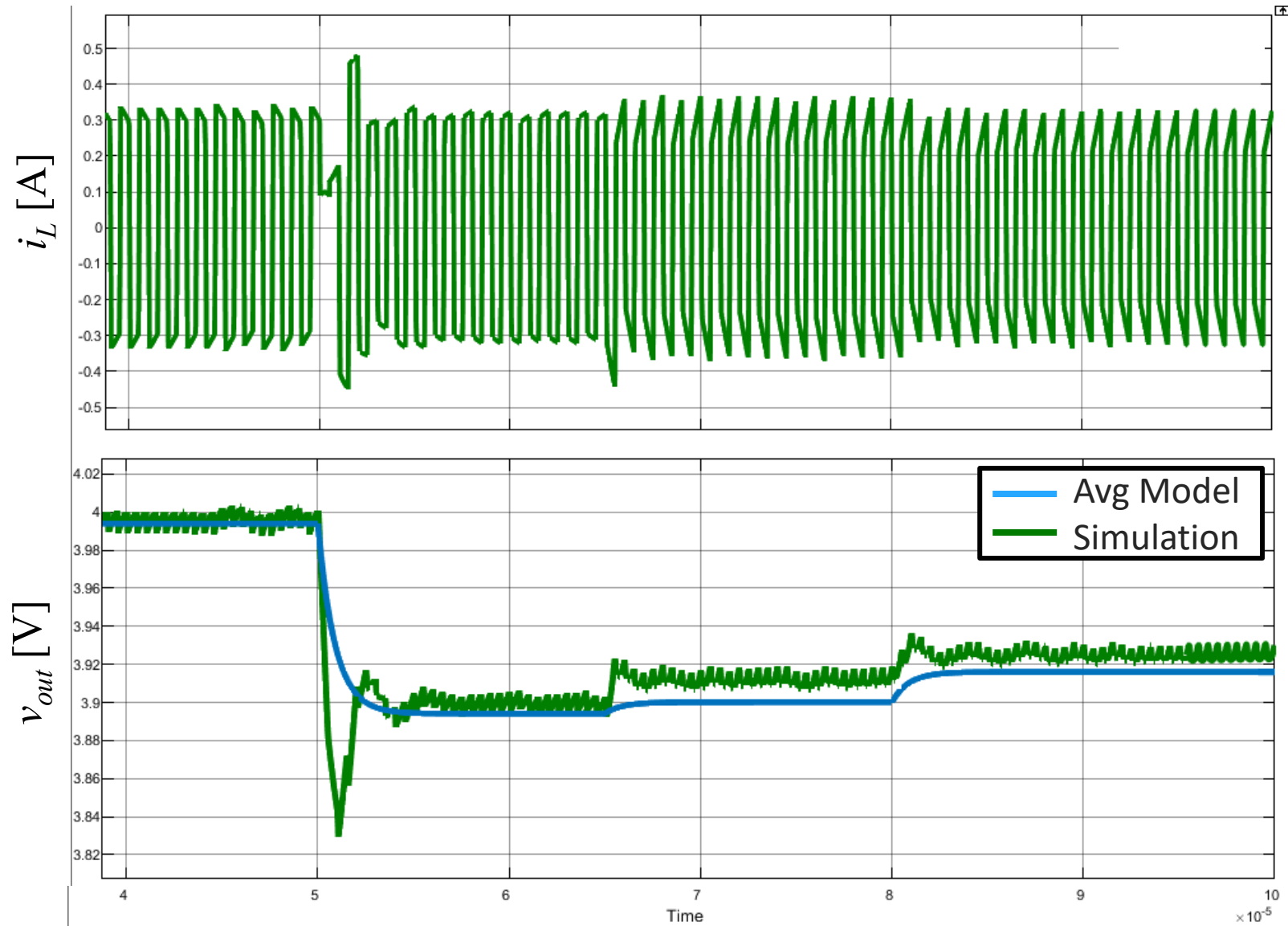
Parameter	Value
V_g	50 V
V_{out}	4 V
I_{load}	3.5 A
C_{out}	20 μ F
L_l	9.5 μ H
n_t	25:2
f_s	1 MHz
η_{pk}	97%



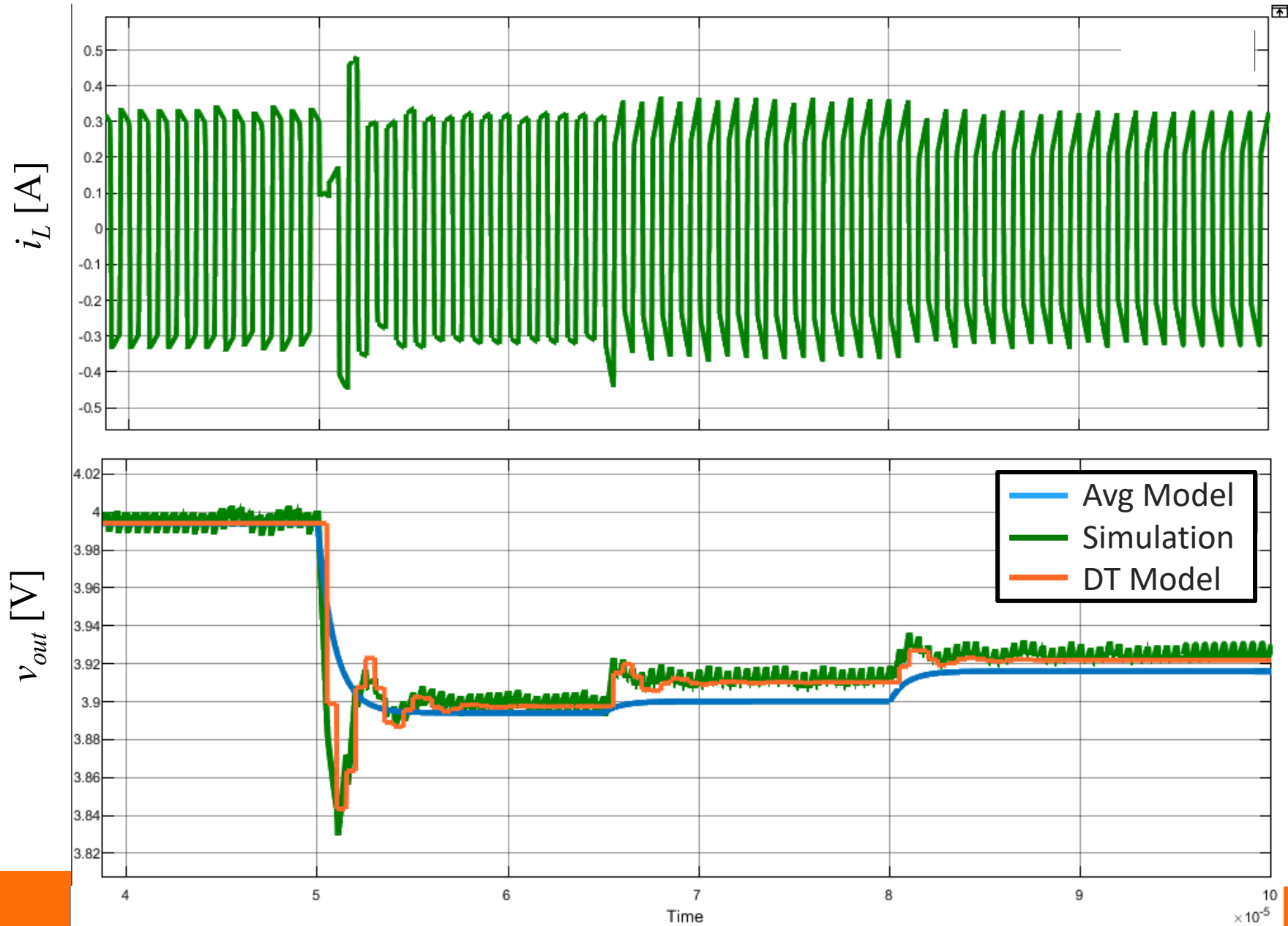
Control Design



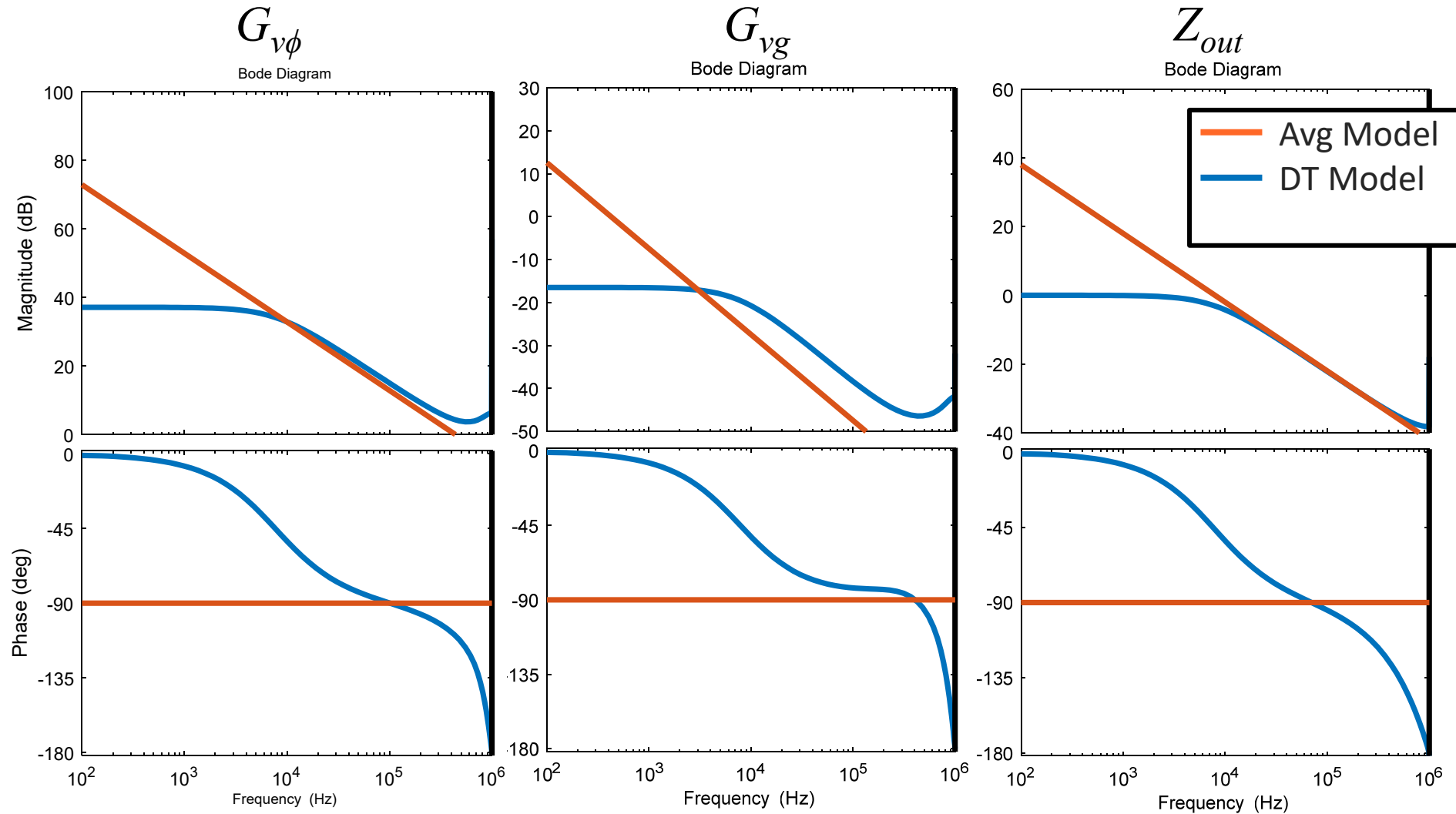
Averaged Model Comparison



Discrete Time Model Comparison



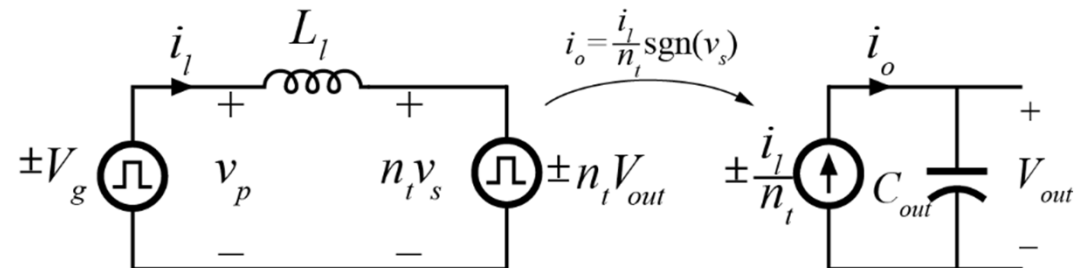
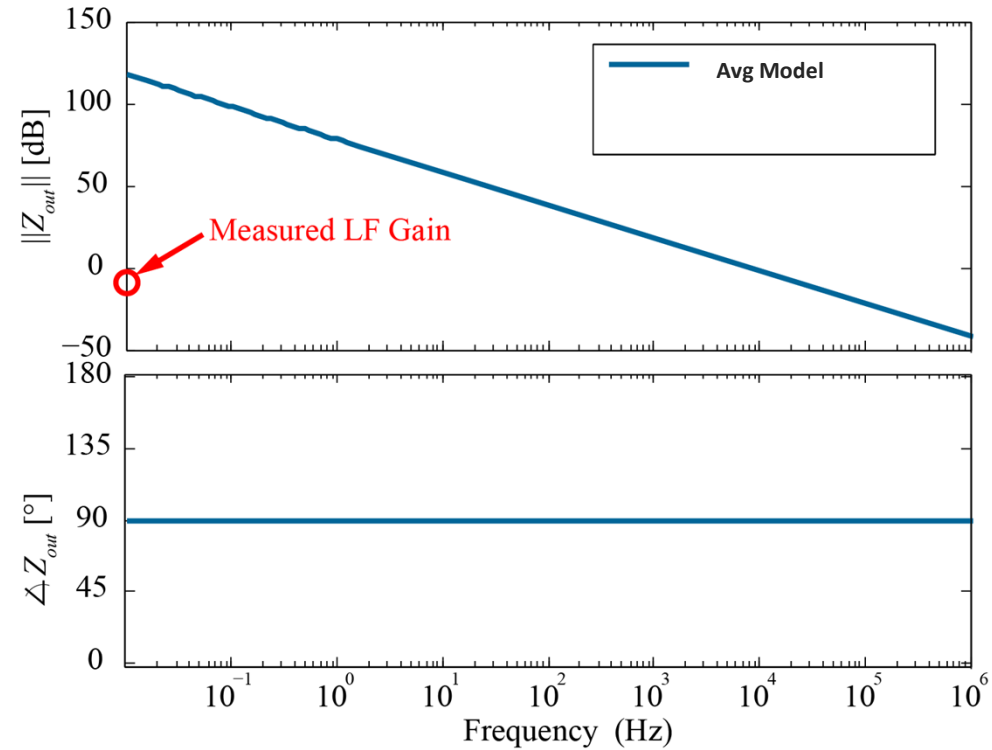
Transfer Function Comparison



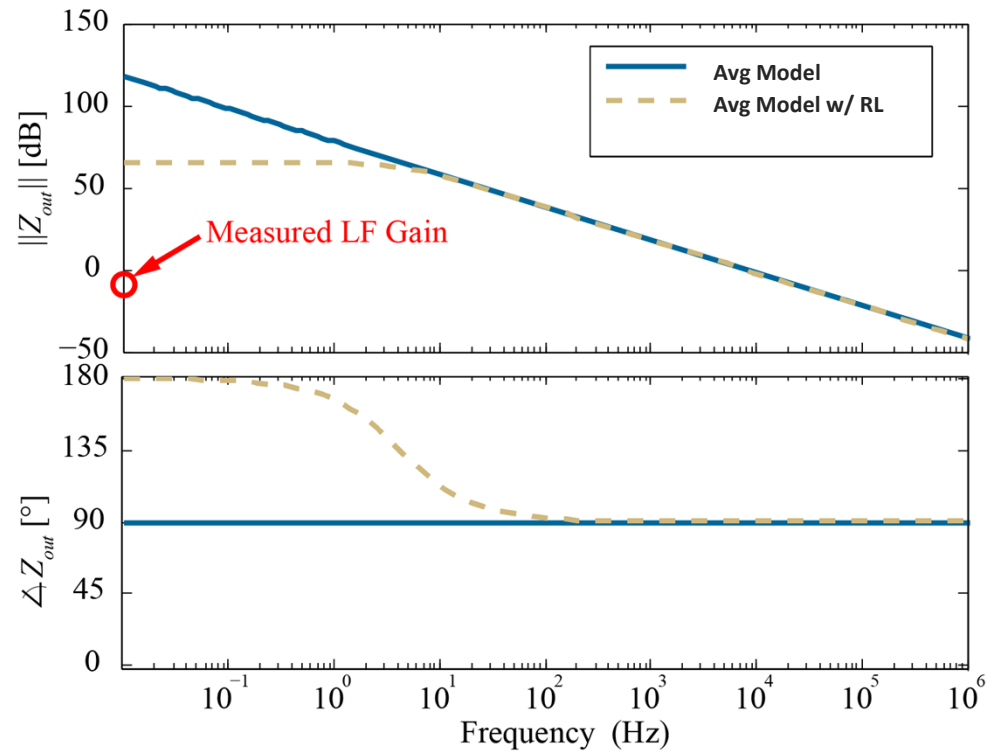
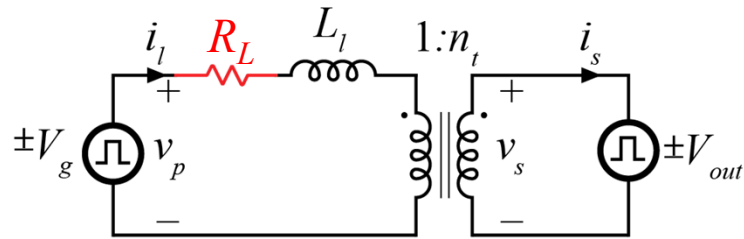
Experimental Measurement of Z_{out}

- Prototype DAB constructed

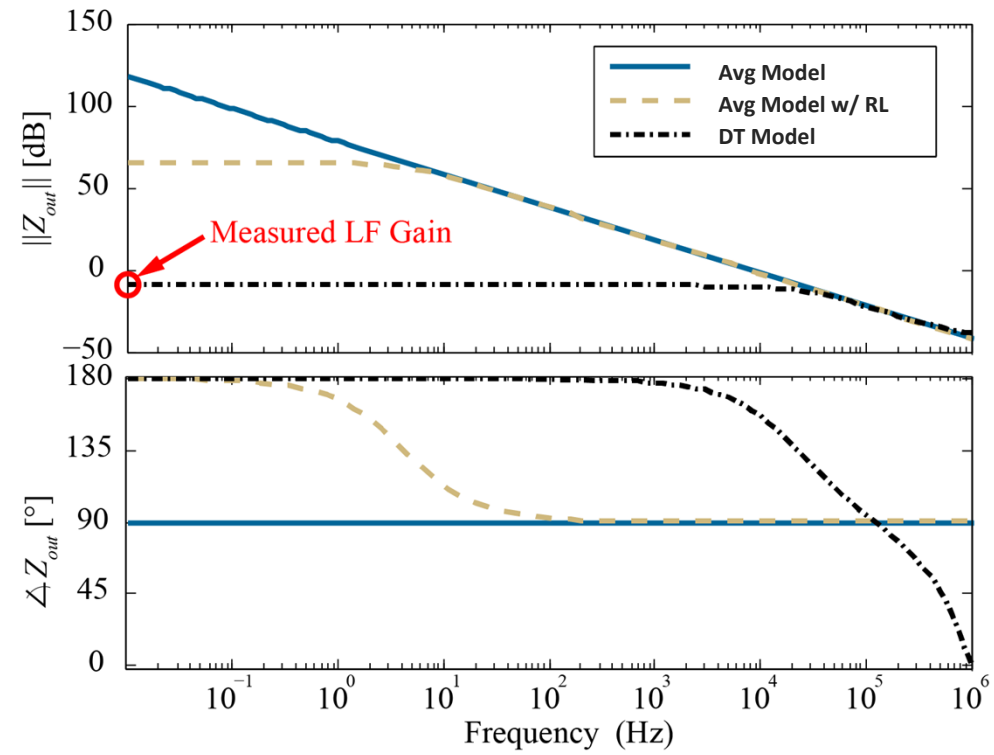
Parameter	Value
V_g	50 V
V_{out}	4 V
I_{load}	2.5-3.5 A
C_{out}	20 μ F
L_l	9.5 μ H
n_t	25:2
η_{pk}	97%



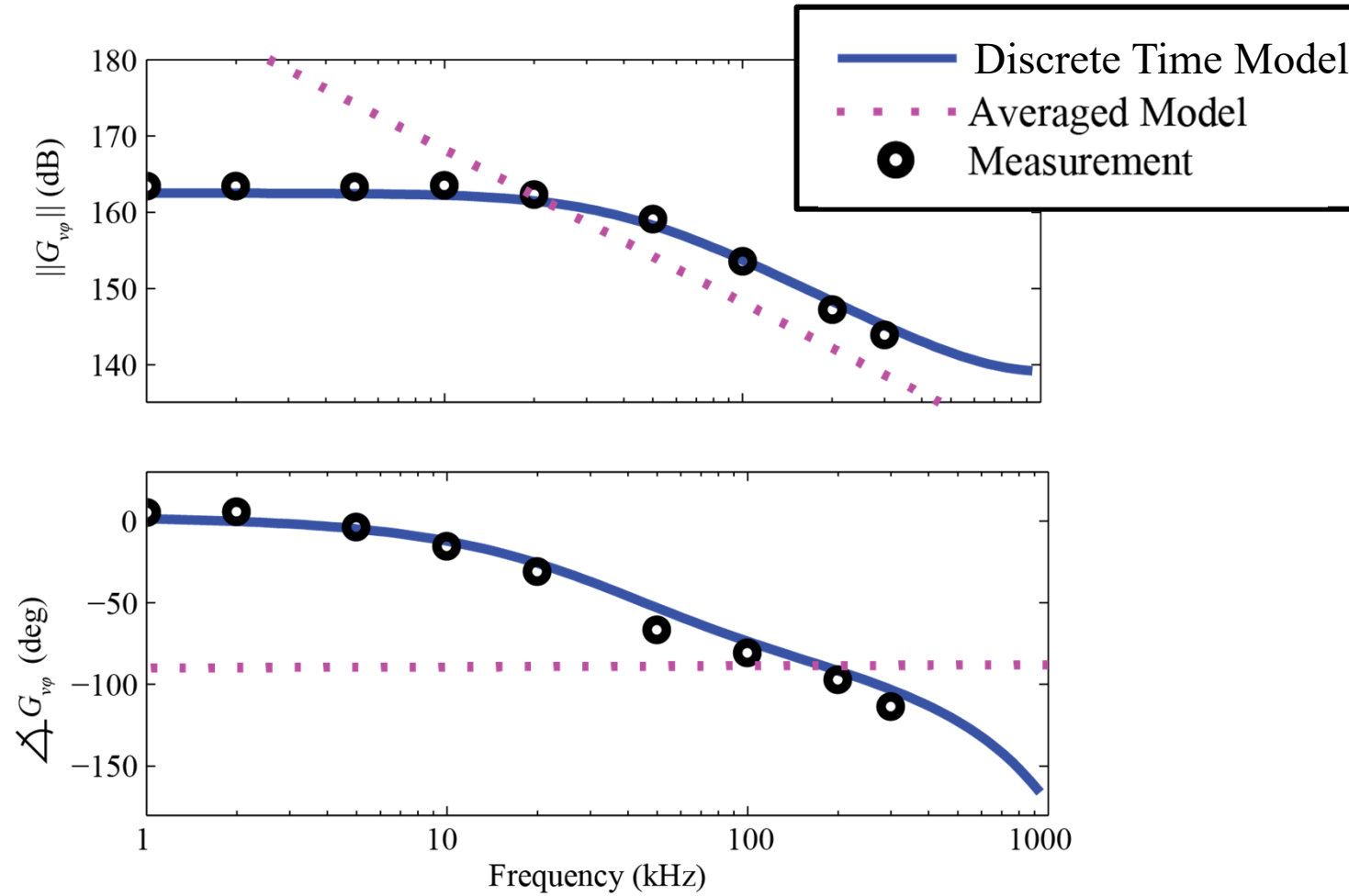
Including Conduction Losses



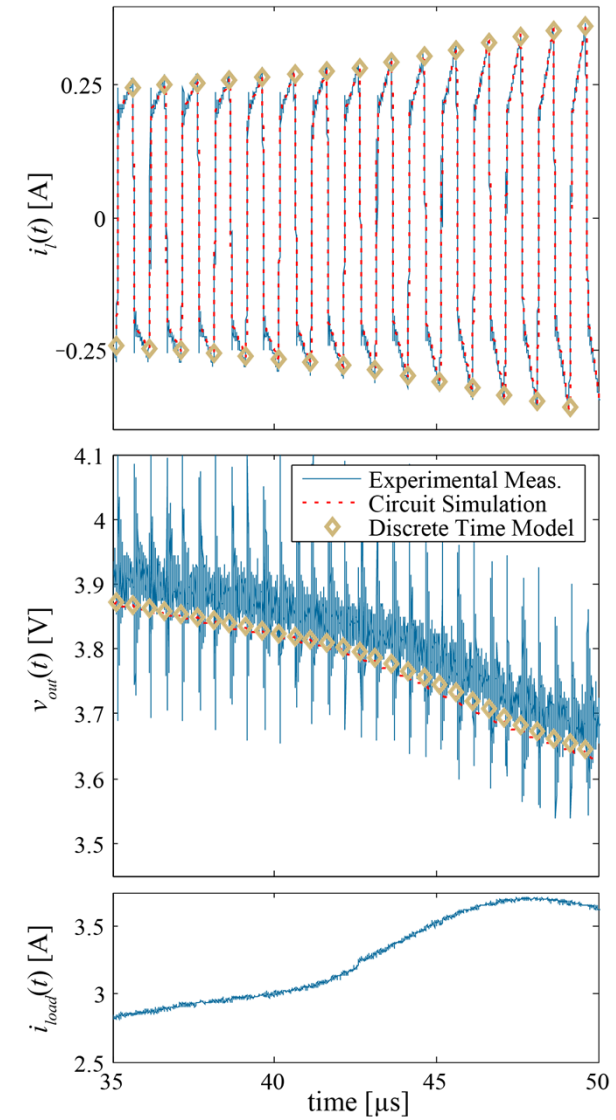
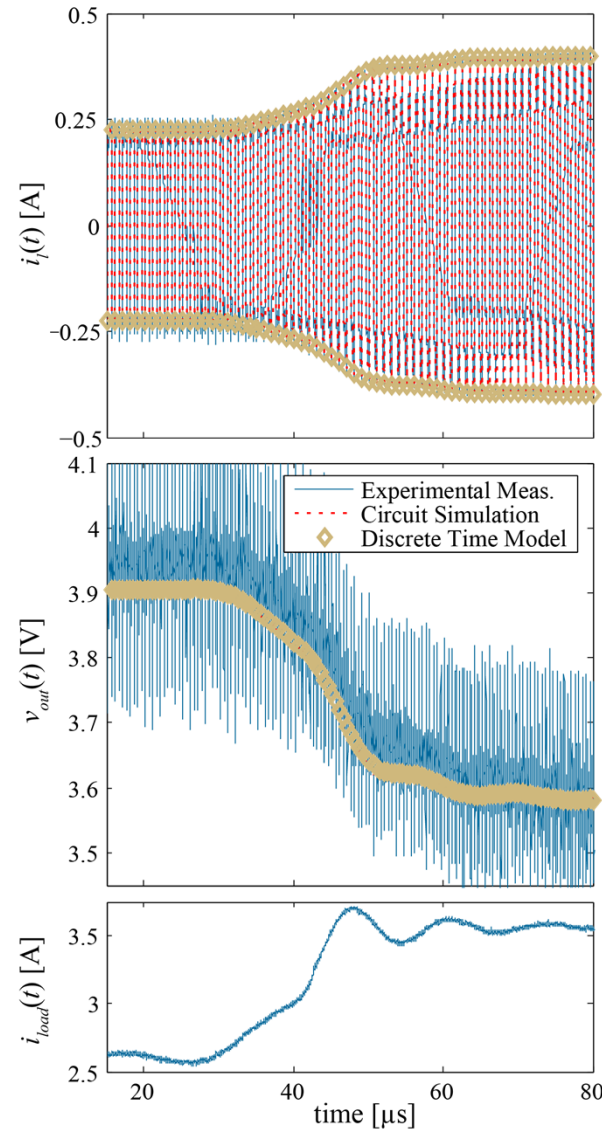
Discrete Time Model: Results



Control-to-Output Transfer Function



Transient Comparison



Topics Covered

- Steady-state modeling of switched systems
 - State space representation
 - Discrete time model
 - Steady-state solution
 - Averaging and singularities
- Dynamic models of switched systems
 - Small-signal discrete time modeling
 - Model reduction
 - DPWM and ADC
 - Delays and Quantization
- Digital Control
 - Hardware implementation
 - Compensator Design
 - Advanced techniques
- Additional Topics in design and control of power electronics