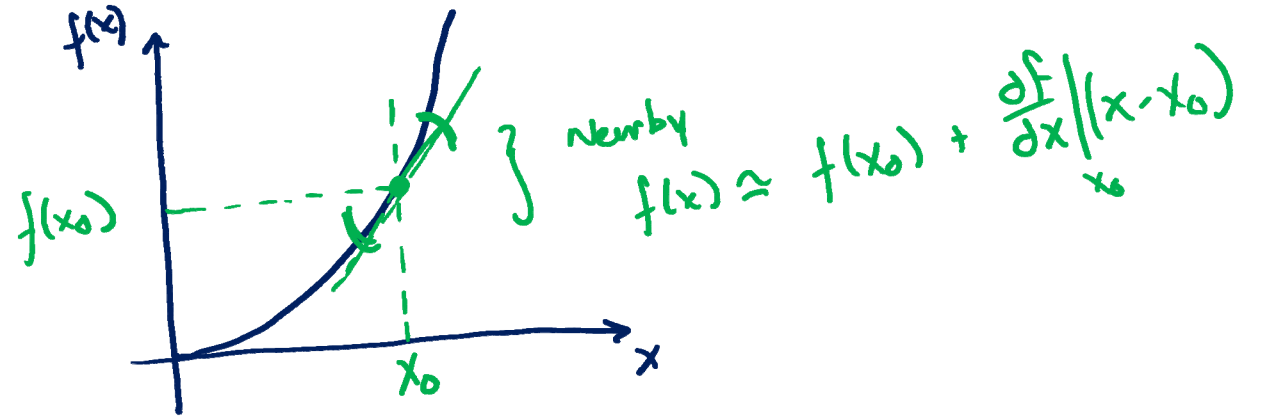


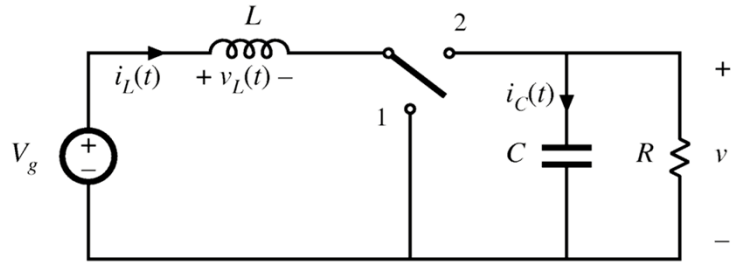
Small Signal Modeling: Linearization



(1) Perturb and Linearize

(2) 1st order Taylor Series Expansion

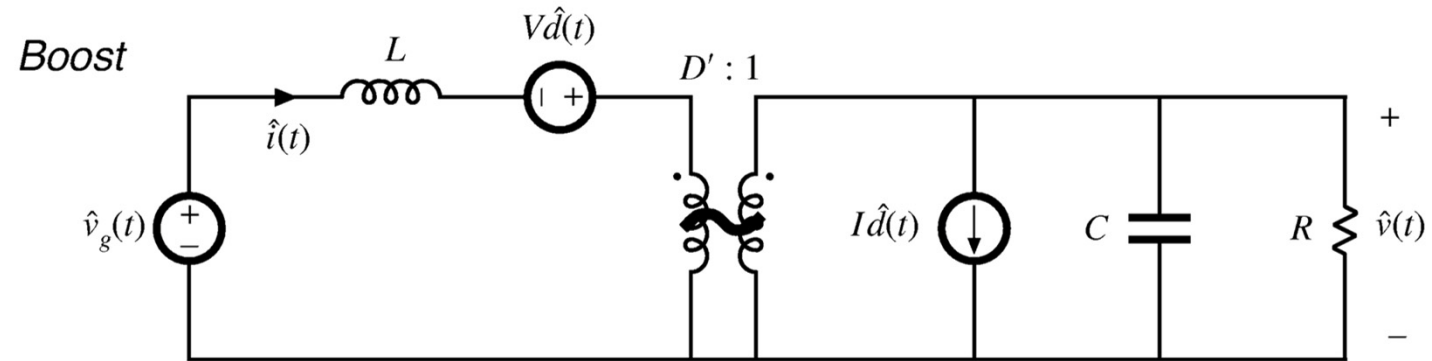
Equivalent Circuit Modeling: Boost Example



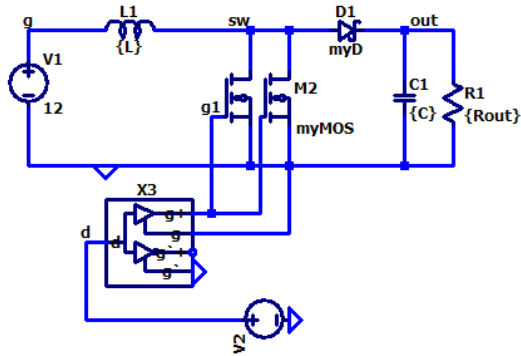
Linearization

Equivalent Circuit Model

Boost Converter Averaged, AC, Linear Circuit Model



Model Simulation



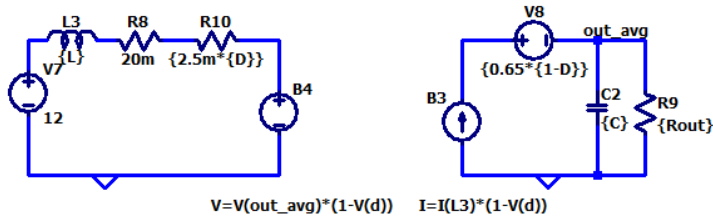
```
.param
+ L = 22u
+ C = 22u
+ Rout = 48
+ D = .755
```

```
.ic V(out)=48 I(L1)=3.1A
```

```
.tran 0 {1500/202k} {800/202k} startup
```

```
.lib myParts.lib
```

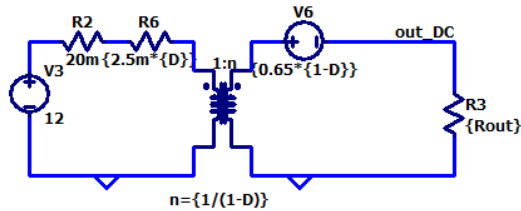
Full Switching Model



```
.ic V(out_avg)=48 I(L3)=4A
```

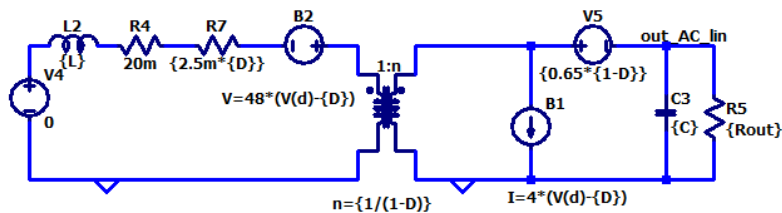
$$V = V(\text{out_avg}) * (1 - V(d)) \quad I = I(L3) * (1 - V(d))$$

Averaged, Nonlinear



$$n = \{1 / (1 - D)\}$$

DC Averaged Model



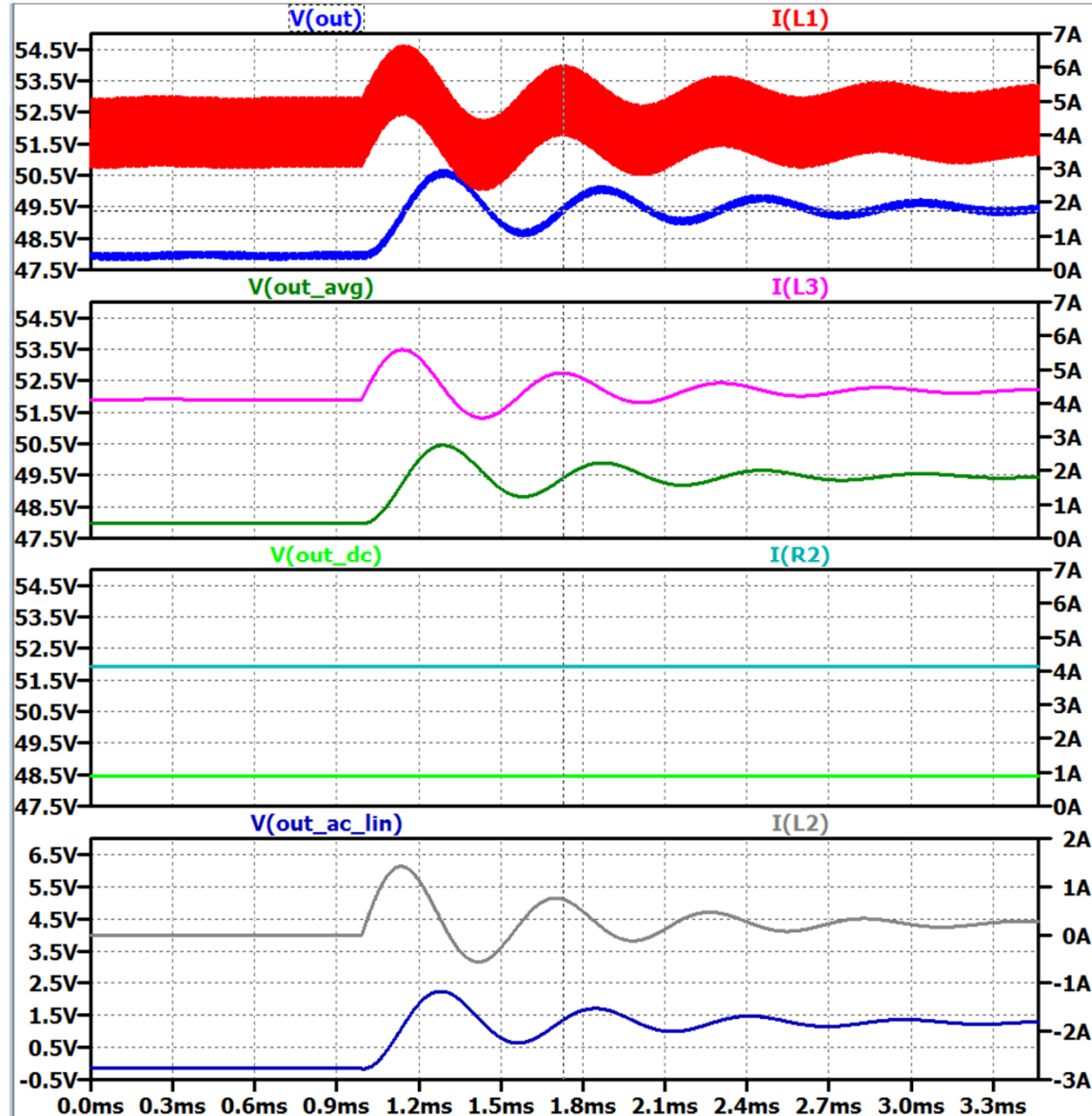
```
.ic V(out_AC_lin)=0 I(L2)=0
```

$$V = 48 * (V(d) - D) \quad I = 4 * (V(d) - D)$$

$$n = \{1 / (1 - D)\}$$

AC Averaged, Linearized Model

Model Comparison



Full Switching Model

Averaged, Nonlinear

DC Averaged Model

AC Averaged,
Linearized Model