for Boost Converter, We know that

$$\text{Duty} = \frac{\text{Vout} - \text{Vin}}{\text{Vout}}$$

if output current is Iout, we could get the coil average current

$$\text{Iaverage} = \frac{\text{Iout}}{1 - \text{Duty}}$$

and we also could get the following equation

$$\frac{1}{2}\cdot \text{Lp}\cdot \text{Ipeak}^2\cdot \frac{1}{\text{Tcycle}} = \text{Vout}\cdot \text{Iout}$$

$$\text{Ipeak} = \frac{\text{Vin}}{\text{Lp}}\cdot \text{Duty}\cdot \text{Tcycle}$$

so

$$\frac{1}{2}\cdot \text{Lp}\cdot \left(\frac{\text{Vin}}{\text{Lp}}\cdot \text{Duty}\cdot \text{Tcycle}\right)^2\cdot \frac{1}{\text{Tcycle}} = \text{Vout}\cdot \text{Iout}\ \text{solve}, \text{Iout} \rightarrow \frac{1}{2\cdot \text{Lp}}\cdot \text{Vin}^2\cdot \text{Duty}^2\cdot \frac{\text{Tcycle}}{\text{Vout}}$$

$$\text{Iout} = \frac{1}{2}\cdot \frac{\text{Vin}}{\text{Lp}}\cdot \text{Vin}\cdot \text{Duty}\cdot \frac{\text{Tcycle}}{\text{Vout}}\cdot \text{Duty} = \frac{1}{2}\cdot \frac{\text{Vin}}{\text{Lp}}\cdot \text{Duty}\cdot \text{Tcycle}\cdot \frac{\text{Vin}}{\text{Vout}}\cdot \text{Duty}$$

We know that

$$\text{Iaverage} = \frac{\int_0^{DT} \frac{\text{Vin}}{\text{Lp}}\cdot t\, dt}{DT} = \frac{\frac{1}{2}\cdot \frac{\text{Vin}}{\text{Lp}}\cdot D^2\cdot T^2}{DT} = \frac{1}{2}\cdot \frac{\text{Vin}}{\text{Lp}}\cdot D\cdot T = \frac{1}{2}\cdot \text{Ipeak} = \frac{\int_{DT}^{T-DT} \frac{\text{Vout} - \text{Vin}}{\text{Lp}}\cdot t\, dt}{T - DT}$$

$$\text{Iaverage} = \frac{1}{2}\cdot \frac{\text{Vin}}{\text{Lp}}\cdot \text{Duty}\cdot \text{Tcycle}$$

so

$$Iout = Iaverage \cdot \frac{Vin}{Vout} \cdot Duty$$

Because

$$\frac{Vin}{Vout} = \frac{Vout}{Vout} - \frac{Vout - Vin}{Vout} = 1 - Duty$$

so

$$Iout = Iaverage \cdot Duty \cdot (1 - Duty)$$

$$Iaverage = \frac{Iout}{Duty \cdot (1 - Duty)}$$

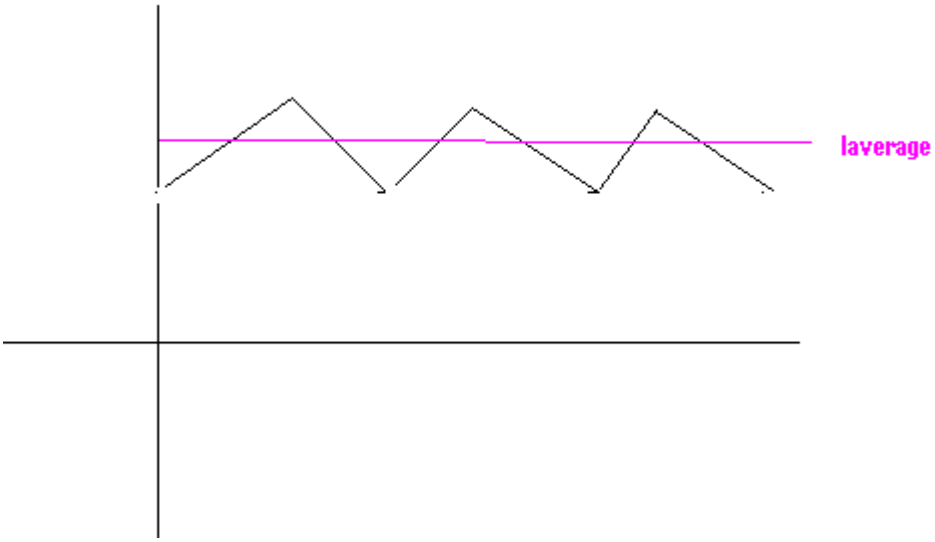
The following are based on CRM.

Two calculation method, we get two different results, so which one is right?

using the following equation, we could get the same result in the CCM

$$\frac{1}{2} \cdot Lp \cdot \left[\left(Iaverage + \frac{Vin \cdot D \cdot T}{2 \cdot Lp} \right)^2 - \left(Iaverage - \frac{Vin \cdot D \cdot T}{2 \cdot Lp} \right)^2 \right] \cdot \frac{1}{T} = Vout \cdot Iout \text{ solve}, Iaverage \rightarrow Vout \cdot \frac{1}{V}$$

$$Iaverage = \frac{Vout}{Vin} \cdot \frac{Iout}{D} = \frac{Iout}{D} \cdot \frac{1}{1 - D}$$


laverage

$$\frac{[\text{out}}{\text{in}\cdot D}$$