Buck Regulator Plant Model: Figure 1 shows how the z-transform equations are solved by modeling inductor admittance and capacitor impedance. For now assume the Load current, duty ratio and input voltage are independent variables. Algebraic feedback occurs because, V2, the plant output is fed back to the voltage across the inductor, Ve. That requires solving simultaneous algebraic equations. That's not too bad for the case shown; however, both duty ratio and load current also have feedback terms. This feedback escalates the degree of difficulty for hand coding the difference equations. Fortunately. Backward euler integration yields results that are close enough to be used, albeit, with increased control loop phase lag. Figure 2 shows in bold how the model gets revised, so that the difference equations have no feedback. The equations can now be written by inspection:

```
i3=ILP+ILOAD
V1 = T/C*i3+V1P
V1P = V1 // for the next iteration
V2=V1+R2*i3
Ve=Vin*D-V2
IL = T/(R1*T+L)*Ve+L/(R1*T+L)*ILP
ILP = IL // for the next iteration
```

Two terms are not needed, i3 and Ve. These can be eliminated from the above equations to make the code execute faster; but again, with the increased risk of introducing coding errors. The equations as shown can be inserted in C language code, or reduced by hand to assembly language. DSP C compilers don't do very well at using the MAC, multiply accumulate instruction so that assembly language coding makes a significant (2 to 3 times) faster execution time.

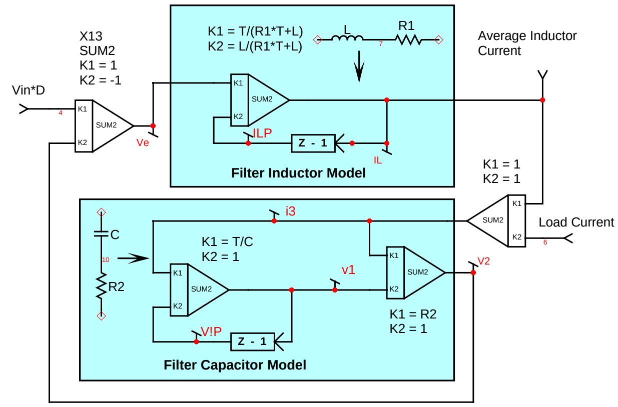

Figure 1, Plant modeled using forward euler integration

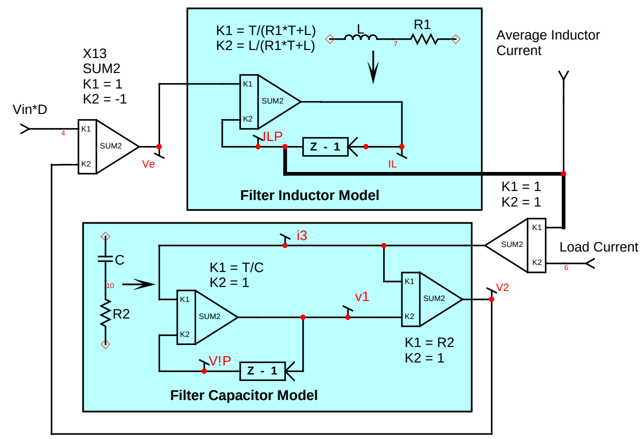

Figure2, Plant modeled using backward euler integration