11.1 Introduction

In a sense, the power stage containing $V_s$, $L$, $R_s$ and $Q$ of a boost converter (Fig. 11-1), behaves more like a current source than a voltage source. It is generally used as a backup power subsystem, for instance, spacecraft backup power during an eclipse in which the battery, usually at a lower voltage, is discharged to maintain the bus at a higher voltage. Under the steady-state condition and when the switch, $Q$, is on, $V_c$ is pulled to near ground. The blocking diode is reverse biased and the capacitor, $C$, discharges to maintain the output, $V_o$, while energy is being stored in the inductor, $L$. When the switch is turned off, the reverse voltage of the inductor is added to the source voltage, $V_s$, such that $V_c$ is higher than the output voltage and makes the diode conduct. A conducting diode means that $V_c$ is clamped to a voltage that equals the sum of the output and the diode forward drop. In this off-time interval, the energy

Figure 11-1 Boost converter, $V_s < V_o$
previously stored in the inductor is released to replenish the capacitor and to support the load. In this manner a complete on/off cycle is accomplished and Fig. 11-2 shows the waveform of major currents and voltages.

**11.2 Steady-State Duty Cycle Equation**

From the pulsating current waveform of \( i_d \), it can be easily shown that the amplitude of inductor ripple current is

\[
i_A - i_B = \frac{(V_D + V_o - V_F) \cdot (1 - D)}{L \cdot f_s}
\]  

(11.1)