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APPENDIX 2A BASIC TRANSFER FUNCTIONS FOR CONVERTERS

Further to the analysis of converters using the PWM switch, we have gathered in this appendix the transfer equations of the three basic converters operated in fixed switching frequency, DCM or CCM, voltage-mode or current-mode control. You will sometimes see two forms of equations. The first one corresponds to the simplified version of the second one, whose expression does not lend itself easily to an immediate implementation. Thanks to the SPICE implementation via small-signal models (or linearized large-signal models), you can avoid manipulating them. However, keep in mind that the key to stabilizing a power supply lies in the knowledge of the pole-zero locations and how they move in relation to stray elements or input/output parameters.

In all the following equations, we will have

V_{peak}	Sawtooth amplitude for the voltage-mode PWM modulator
r_{Cf}	Output capacitor ESR
r_{Lf}	Inductor ESR
R	Load resistor
C	Output capacitor
L	Inductor
M	Conversion ratio $\frac{V_{out}}{V_{in}}$
D	On duty cycle
D'	Off duty cycle, also denoted by $1 - D$, depending on the mood
T_s	Switching period