Unit 11 - Week 9

Assignment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-04-01, 23:59 IST.

1) State whether the following statement is true or false. "A current-mode hysteretic converter is unstable when the output capacitor has no R_{ESR}." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

2) State whether the following statement is true or false. "A voltage-mode hysteretic converter may be unstable if the output capacitor's $R_{ESR} < T_{SW}/2C_O$." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

3) State whether the following statement is true or false. "For a fixed output voltage, the switching frequency of a hysteretic buck converter increases with decrease in duty cycle, when all losses are neglected." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

4) State whether the following statement is true or false. "Current-mode hysteretic control offers a faster transient response than voltage-mode hysteretic control." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

5) State whether the following statement is true or false. "Current-mode hysteretic control ensures a smaller ripple at the output than voltage-mode hysteretic control." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

6) A hysteretic buck converter was designed to operate at a switching frequency of 1 MHz and a duty cycle of 50%. Assuming a fixed output but a varying input and neglecting all losses, the switching frequency would ____. *1 point*

- increase at D>50% and decrease at D<50%
- decrease at D>50% and increase at D<50%
- decrease at both D>50% and D<50%
- remain constant

No, the answer is incorrect.
Score: 0
Accepted Answers:
decrease at D>50% and increase at D<50%

Consider the hysteretic buck converter shown in Figure 1, for questions 7 to 10. It needs to be designed for the following specifications.
V_{IN} = 1.8 V to 2.5 V, V_{REF} = 1 V to 1.5 V, L = 1 µH, C_O = 10 µF, C_F = 20 pF and peak-to-peak comparator hysteresis ΔV_H = 50 mV (i.e. ±25 mV).
The MOSFET M_{RST} is operated with a signal RST, which resets the node V_F at both the positive and negative edges of V_{PWM} . Ignore all losses and delays.
Adhere to the units mentioned in the question while filling in numerical answers.

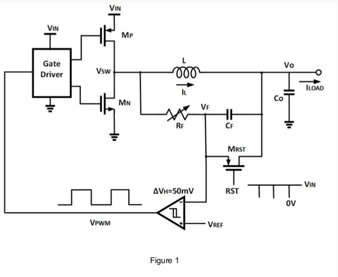
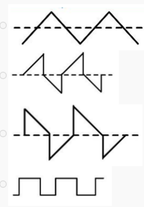


Figure 1

7) Identify the waveform of the voltage V_F (in respect of the hysteretic buck converter shown in Figure 1) amongst the choices provided below. *1 point*



No, the answer is incorrect.
Score: 0
Accepted Answers:

8) Fill in the blank with a numerical answer: The value of R_F (in respect of the hysteretic buck converter shown in Figure 1) that is required to achieve a switching frequency (F_{SW}) of 10 MHz at V_{IN} = 2 V and V_O = 1 V, is ____ kΩ (no decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 100

1 point

9) Fill in the blank with a numerical answer: The minimum value of R_F over the given range of variation of V_{IN} and V_{REF} (in respect of the hysteretic buck converter shown in Figure 1) that is required to maintain a switching frequency (F_{SW}) of 10 MHz, is ____ kΩ (no decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 49.5,50.5

1 point

10) Fill in the blank with a numerical answer: The maximum value of R_F over the given range of variation of V_{IN} and V_{REF} (in respect of the hysteretic buck converter shown in Figure 1) that is required to maintain a switching frequency (F_{SW}) of 10 MHz, is ____ kΩ (no decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 125

1 point

Consider the switching DC-DC converter shown in Figure 2, for questions 11 to 14. ϕ_1 is a PWM signal with a duty cycle of D and ϕ_2 is the corresponding non-overlapped and inverted PWM signal. Assume that the switches are ideal and that the inductor is lossless. Assume that the converter always
operates in CCM. Adhere to the units mentioned in the question while filling in numerical answers.

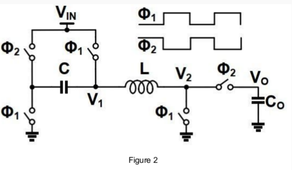


Figure 2

11) What is the expression for the voltage conversion ratio (V_O/V_{IN}) in terms of the duty cycle (D) of the PWM signal ϕ_1 (in respect of the converter shown in Figure 2)? *2 points*

- 1/(1-D)
- (1-D)/(2-D)
- D/(1-D)
- (2-D)/(1-D)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(2-D)/(1-D)

12) Fill in the blank with a numerical answer: The value of the output voltage (in respect of the converter shown in Figure 2) when V_{IN} = 1.5 V and D = 0.4, is V_O = ____ volt (no decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 4

1 point

13) Fill in the blank with a numerical answer: Assuming that L = 1 µH and F_{sw} = 1 MHz (in respect of question 12), the peak-to-peak inductor ripple current (of the converter shown in Figure 2) is ____ mA (no decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 600

1 point

14) Fill in the blank with a numerical answer: Assuming that L = 1 µH and F_{sw} = 1 MHz (in respect of question 12), the average value of the inductor current (of the converter shown in Figure 2) at a load resistance of 4 Ω, is ____ A (up to 1 decimal place).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.6,1.7

1 point