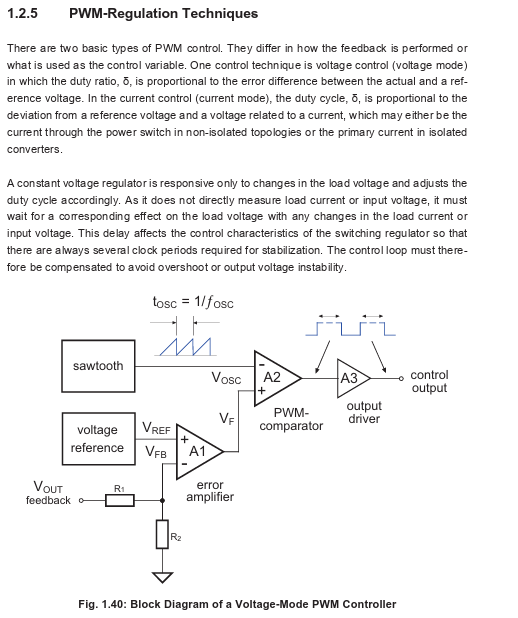
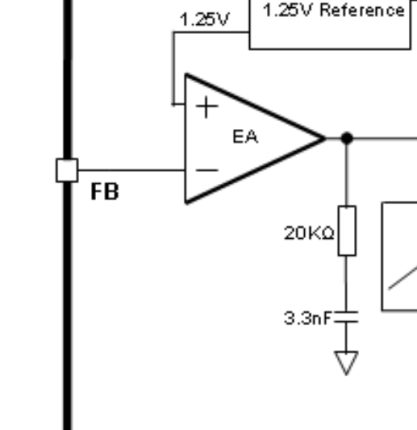
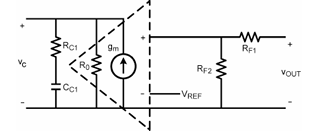
I’ll share pwm regulation techniques page numbers from the book I send you from discord before, dc/dc book of knowledge. Also, I put this book with application notes into same folder, that you can check for lots of things like capacitor types and their properties. I don’t think I can explain pwm regulation better than this. Pages : 46, 47, 48

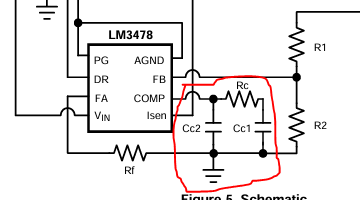
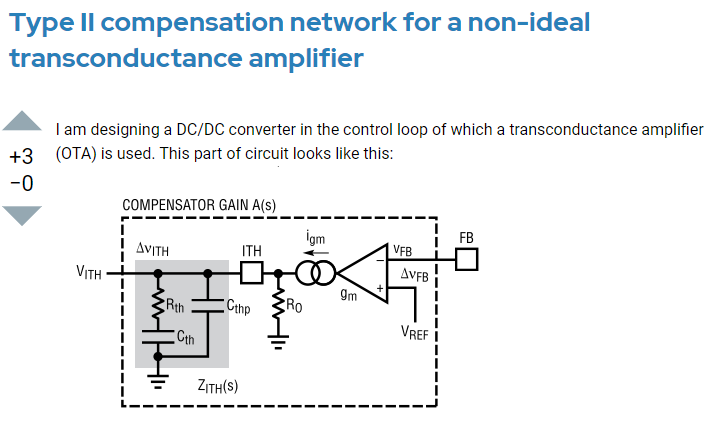


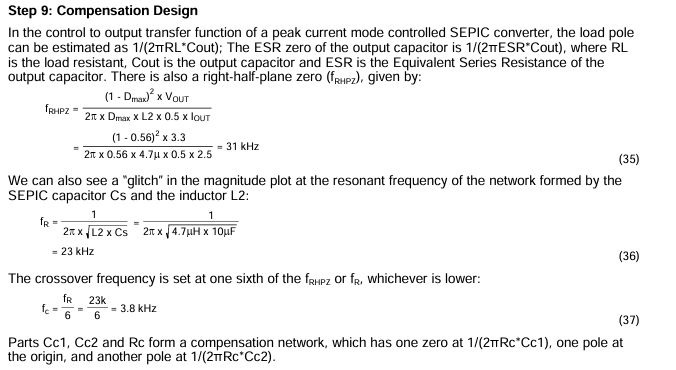
So, now im gonna explain how to implement voltage mode pwm control discretely. Not compensation nor fet driver circuit will be included. Because I show usally how compensator calculation works in current mode. And not gonna show how to implement current mode discretely. Because, it doesn’t make sense to implement discretely expense wise.

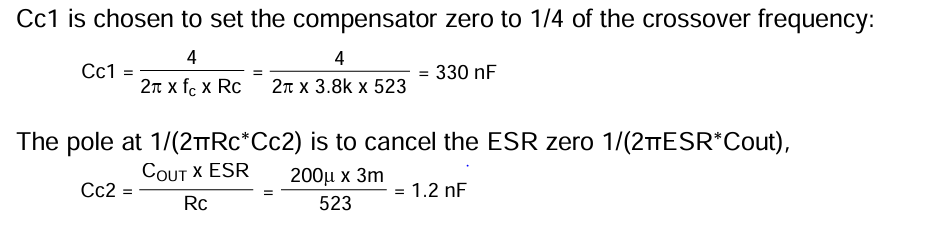
But first I can explain how to do compensator design. We did a lag compensator which is below.

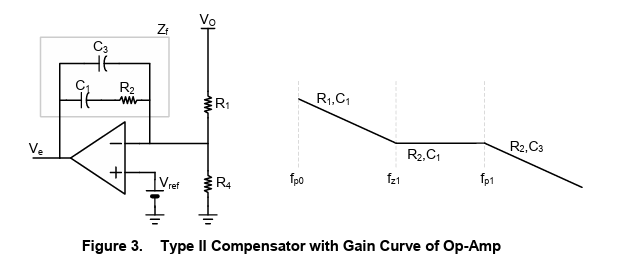
But also you can design type II using SNVA168E application note of cut-off and pole frequency calculations. I show compensator network to point out it’s different. For a second dont think second cc2. Cc1 will have different impedance for different frequencies. So, you can think like Cc1 like a resistor. Rc +Rc1 will give you different gain for different frequencies. So, it is not important to my knowledge if resistor or capacitor is first.

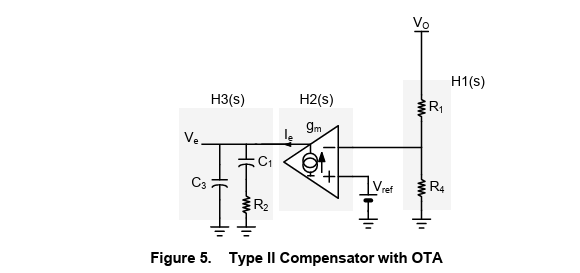




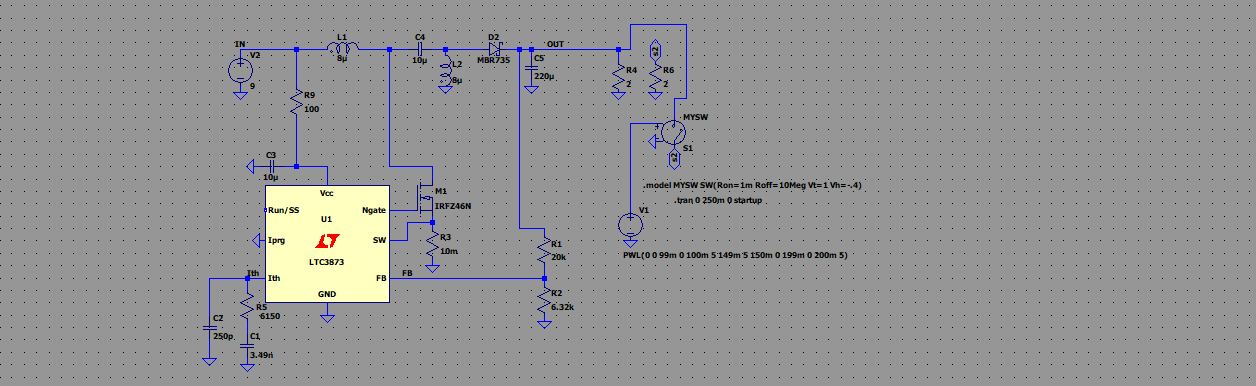


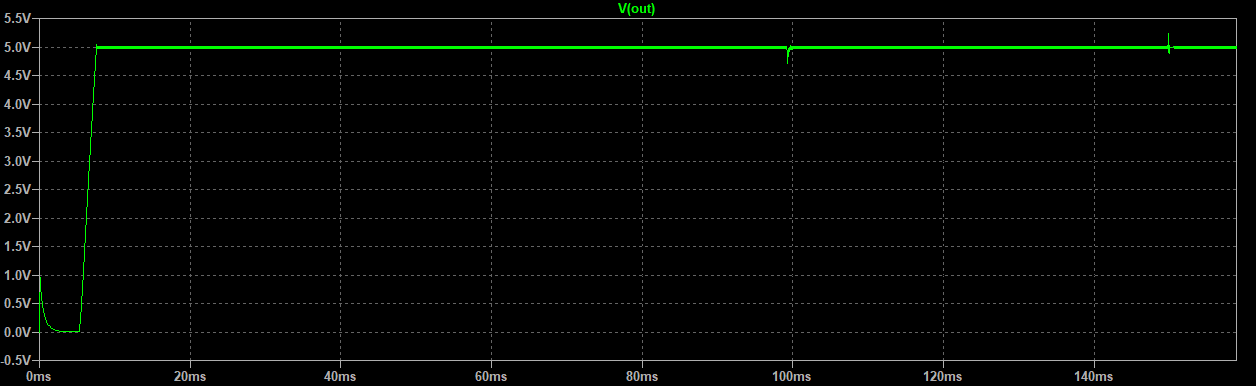
And using SLVA662 to implement an Type II controller using an OTA or Op-Amp. Or just use SNVA168E calculations. I included compensator calculations according to SNVA168E.

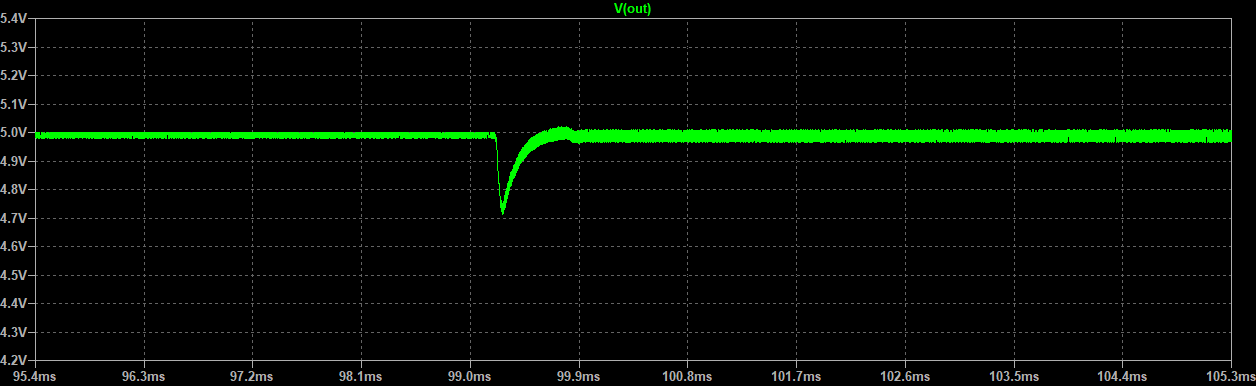


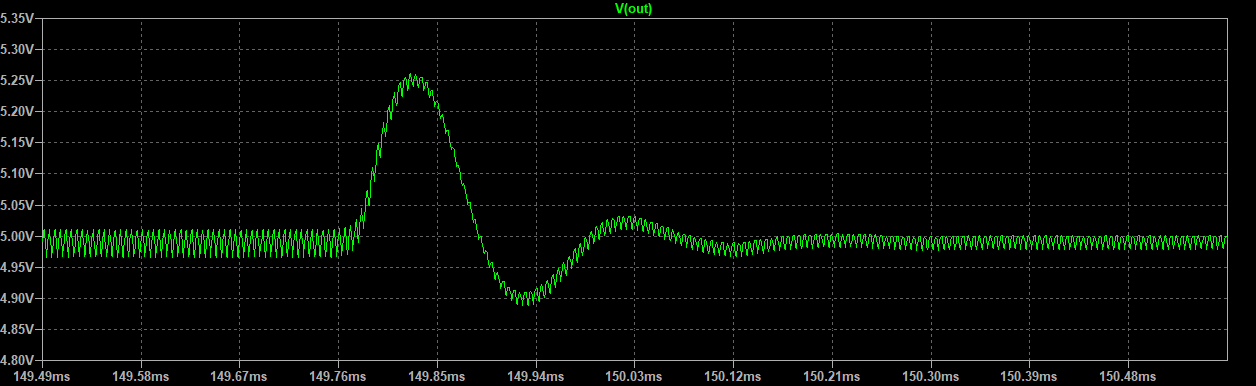


While writing this I calculated for the same power stage we used with Excel I prepared so the result is this. Note, I couldnt find any current sense gain transfer function or formula for current mode sepic converter to use so current gain = 1.

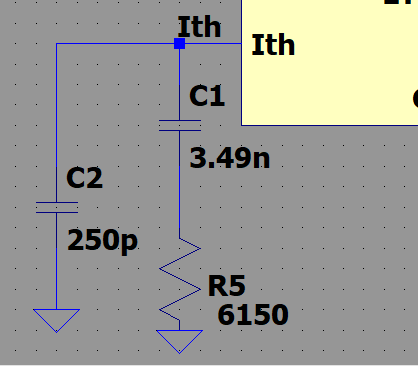


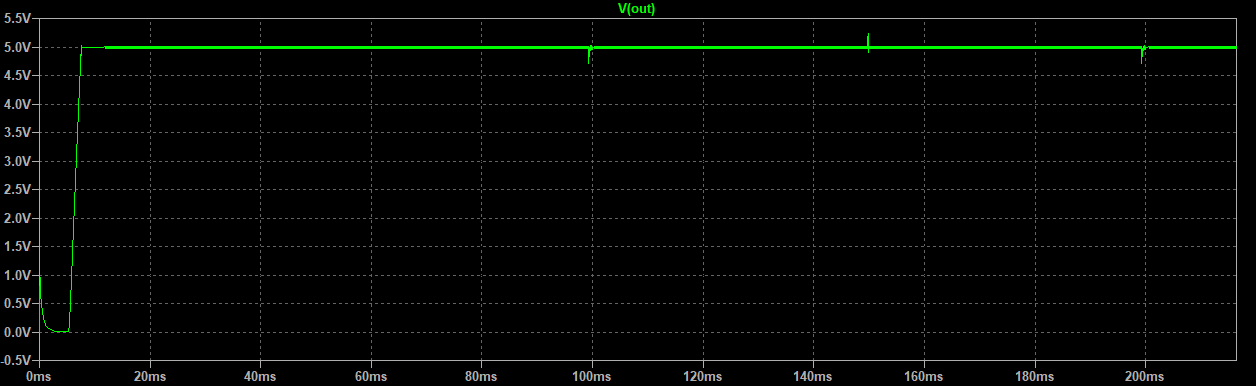


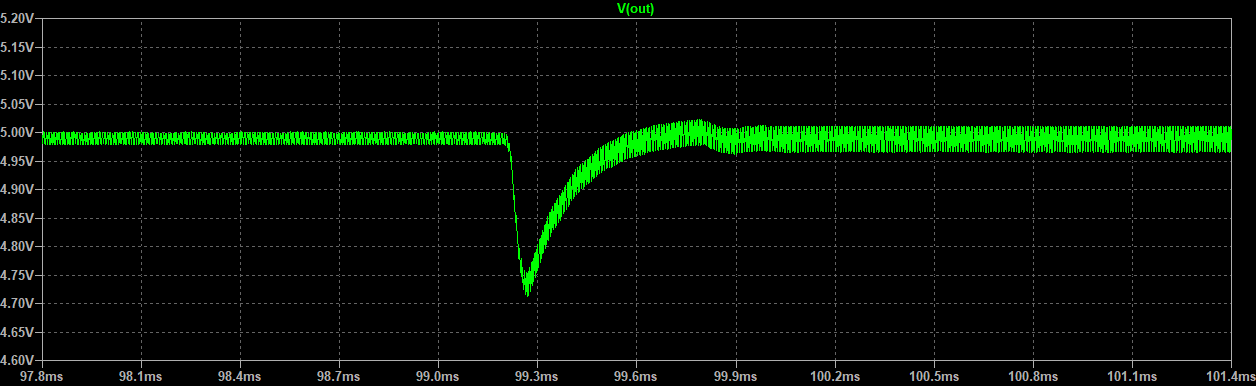


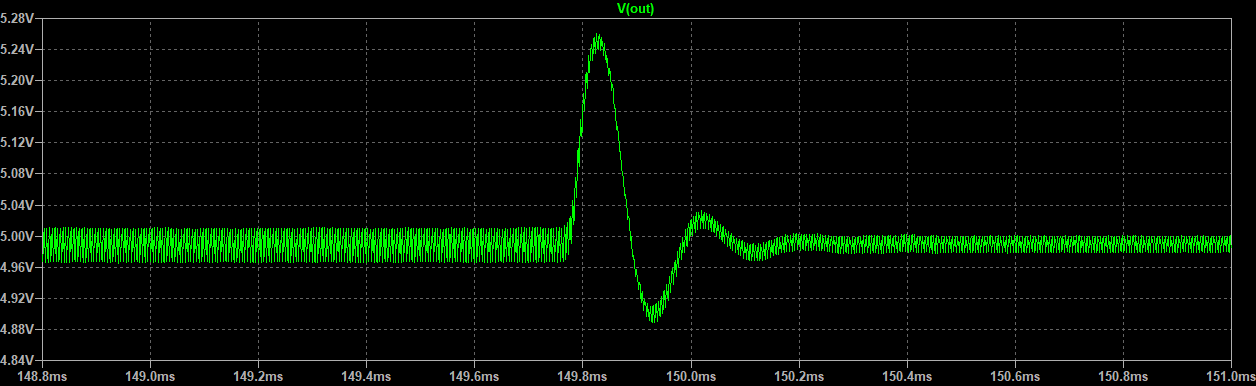


This result much more better and isnt a suprise because it is so muhc closer to lag compensator values I used with trial and error. Also, I tried changing rc1 cc1 places to show you it doesn’t matter like I said. It worked better on simulation. Also, sorry for back and forward situation of this documentation but, desiging controllers usally this type of work.

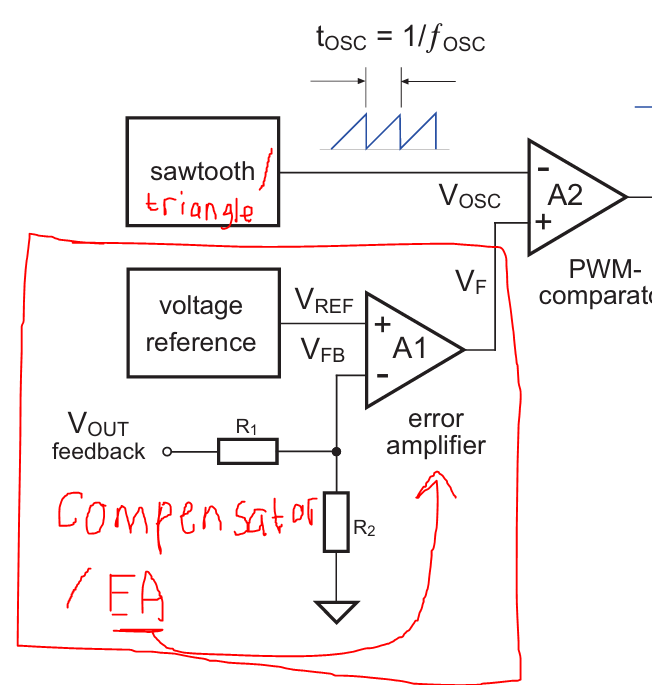




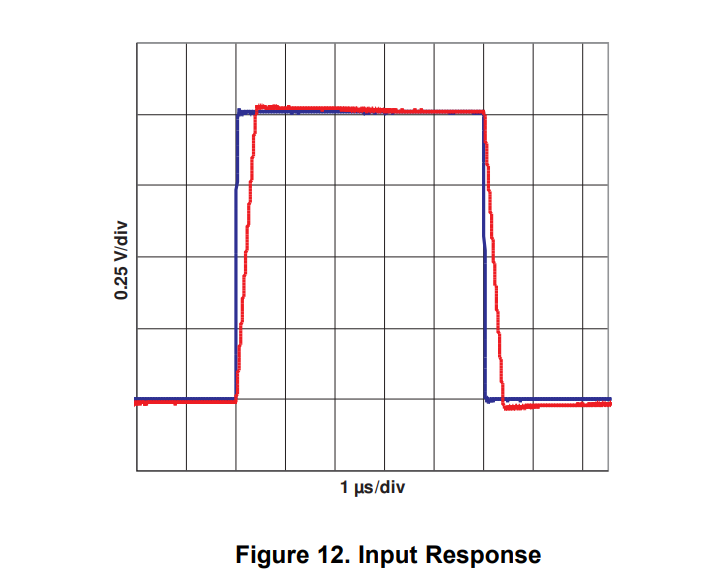




Now, we are going to show you 1 way of triangle wave. But, you can use a 555 or 2 transistors and complementary parts to generat ramp voltage to use.



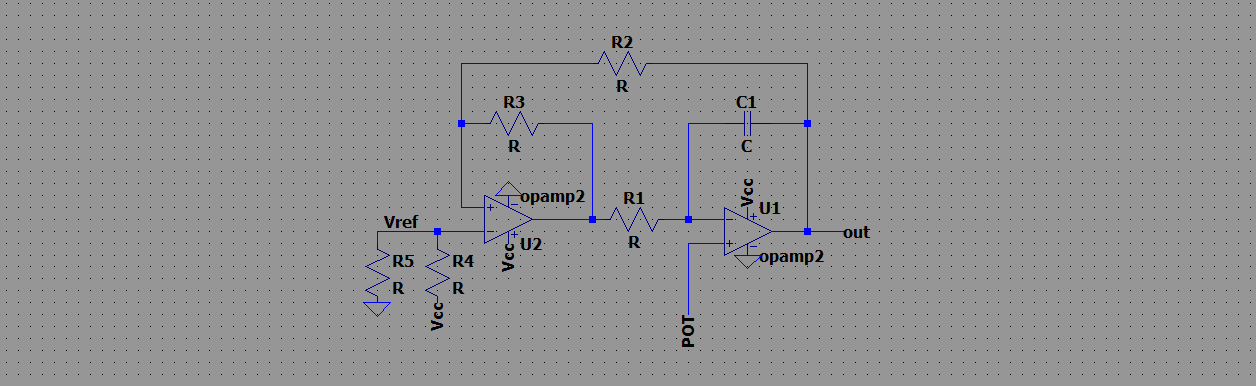
But with using an opamps to generate triangle wave you can simply use one 4 opamp chip for all pwm regulation. 2 opamps for triangle wave, one for error amplifier(compensator), on for pwm comparator. One IC should be better for layout and probably cheaper because at the end you need to use one opamp or ota, one analog comparator, and triangle or ramp generator. Also, It is not ideal to use opamps as an pwm comparator instead of using an analog comperator. But, as long as you don’t go high switching frequency a normal opamp is enough for aspect of speed. For example, you can go up to(with minumum specs of IC by the way) 58kHz – max 80% duty cycle operation under 1 dollar 4 opamp IC that even don’t have that high of a slew rate [TL974IDR](https://www.mouser.com.tr/ProductDetail/Texas-Instruments/TL974IDR?qs=vD%252BlfiDS0%252BOKf6UHUyfKHA%3D%3D). If typical values is thought of, 100kHz- max 80% duty cycle operation.



**Triangle wave**

<https://techpicz.blogspot.com/2012/08/triangular-wave-generator-using-op-amp.html>

Below for single supply



Doesn’t matter which point you out pot. Basically 2 input will be V/2 instead of gnd(for dual +/- supply) but at one input trimmer a pot can be benefical if not oscillation may not start. Also, r2/r3 relation can cause not to oscillate to. R2 shouldnt be so close to r3 as value if circuit doesn’t oscillate.

f = R3 / (4\*R1\*R2\*C1)

Vo(p-p) = (2\*R2 \* Vsat) / R3