Power Management Integrated Circuits
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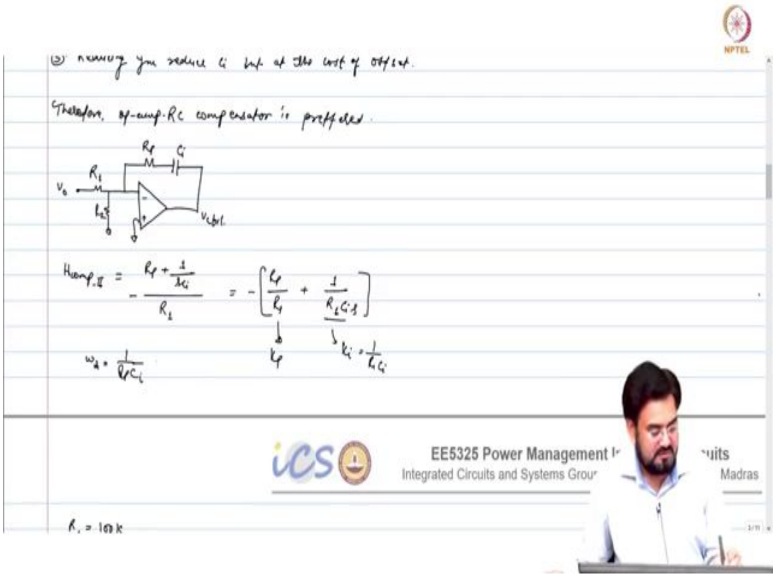
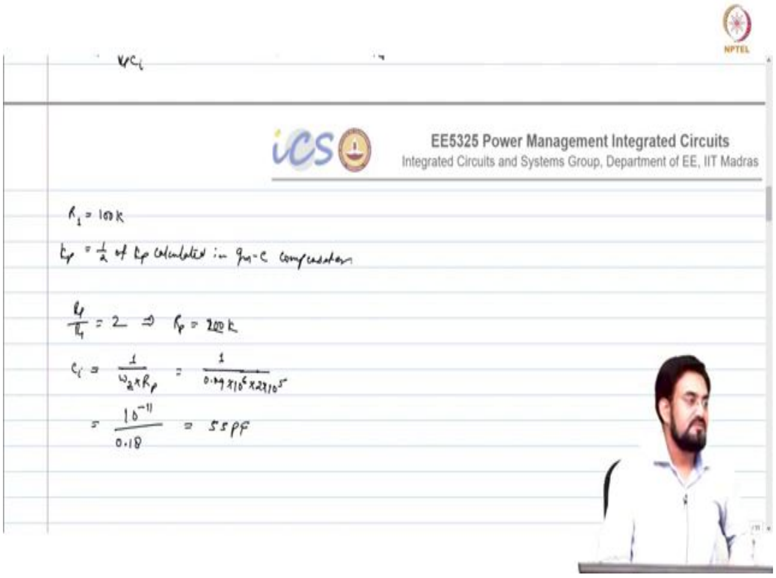
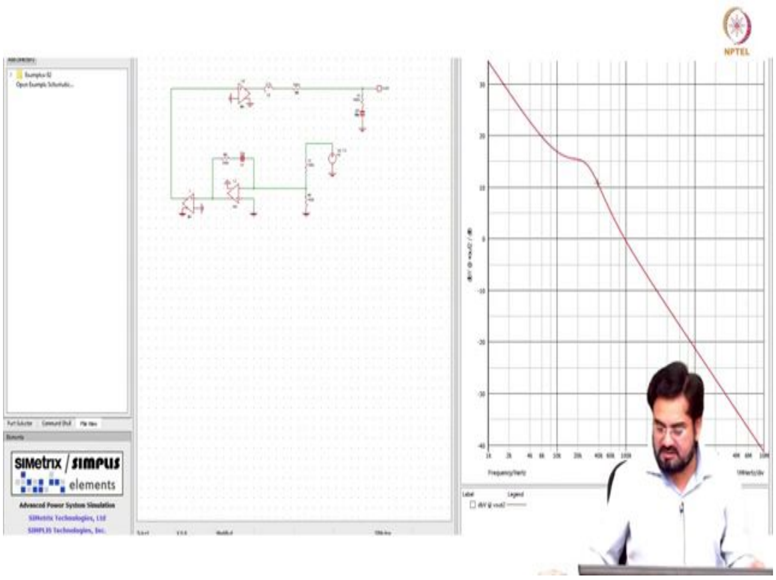
Lecture – 55
Type – II Compensator using op-amp-RC Architecture



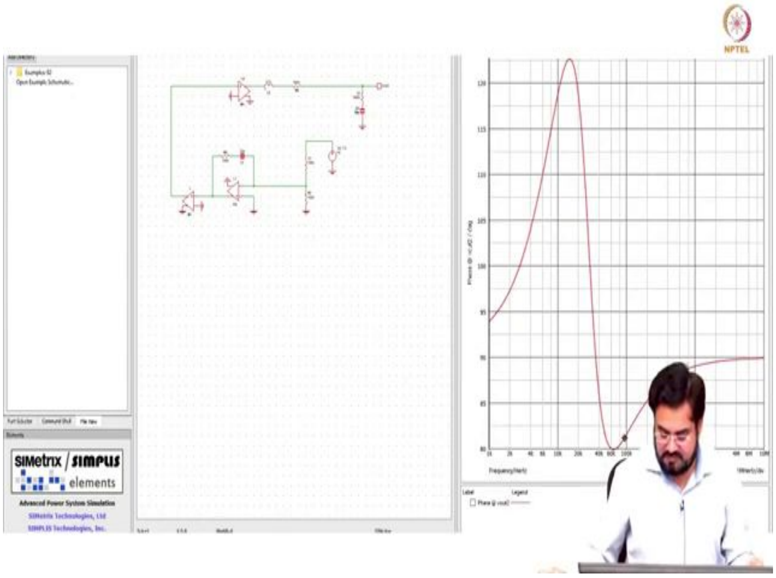
The above image shows the circuit of type-II compensator using Op-amp RC. Here β factor will be one because the top terminal of resistance R_2 is connected to the virtual ground. The transfer function of the compensator with the values of K_p and K_i is shown in the above image. The difference in Op-amp RC compensator compared to the Gm-C compensator is that the gm is replaced by $1/R_1$.



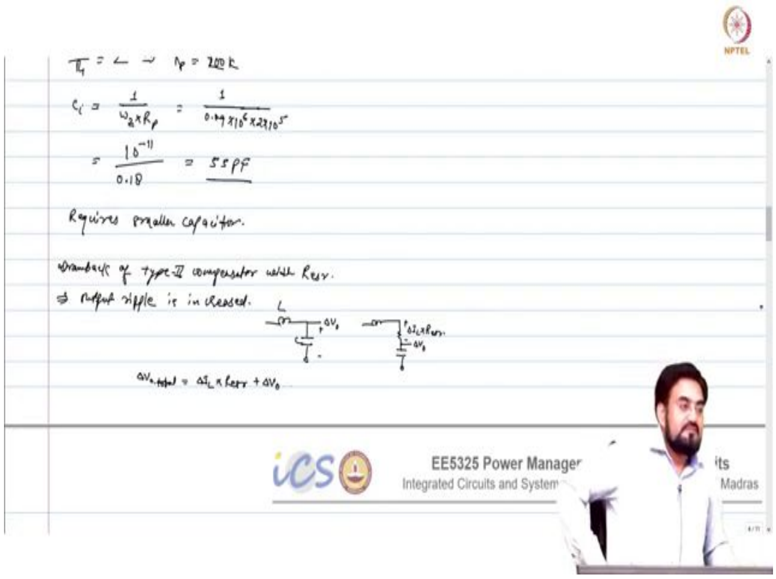
Since the beta factor is one so K_P value will be half of the value calculated in the Gm-C compensator. K_P value in the Gm-C compensator was 4. So K_p value will be 2 in the opamp-RC compensator. The calculation for the R_p and C_i is shown in the above image.



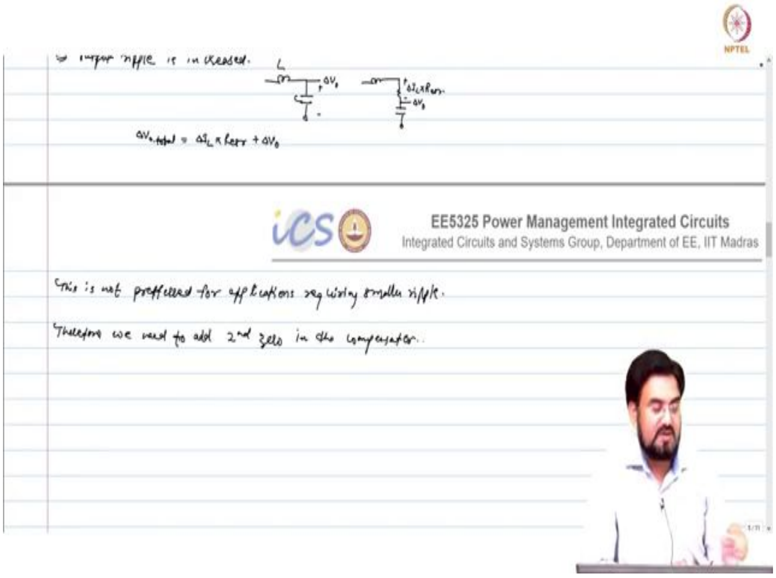
The above image shows the magnitude response of the converter with the Opamp-RC compensator. UGB is around 100kHz.



The above image shows the phase response of the converter with the Opamp-RC compensator. The phase margin is better here compared to the Gm-C compensator. We can use a smaller capacitor here compared to the Gm-C compensator without disturbing the offset because the offset is not dependent on R_P and offset is mainly determined by op-amp gain.



The drawback of Type-II compensator with R_{esr} is that the output ripple is increased. We can see in the above image that the output ripple is increased by $\Delta I_L * R_{esr}$ when we use R_{esr}.



R_{esr} zero is not preferred for the applications where we require small ripples so we have to introduce zero somewhere else. Therefore we need to add the second zero in the compensator.