

## Physics 321: HW 10

Problems 9.3, 10.1, 10.3, 10.11, and 10.12 in Sprott.

Notes:

10.3: Calculating beta (the feedback factor) is a straightforward series and parallel reduction problem, but it gets into a lot of messy complex algebra to solve exactly. For the purposes of the homework problem, you can assume that the three C-R stages operate independently, that is, ignore the current drawn by the following stage (you can think of two op-amps connected as unity gain buffer amplifiers located between the first and second and second and third stages). Now you regard the feedback circuit as three single-pole high pass filters in series (all at the same frequency, so it makes a three-pole high pass), and you already know  $V_{\text{out}}/V_{\text{in}}$  for one stage, so you can just cube it.

The answer will no longer be  $A_0 = 29$ , however, and the frequency of oscillation is somewhat different from that given in 10.2.

If you can use a computer program to do the complex algebra, setting up the exact problem is easy enough.