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Question:

The integrator in my feedback loop is not working properly. It stays at it's saturation voltage no matter how the output of the error amplifier is. Will the microscope work if you take this out from the loop and just amplify the output?

It really can not work with only proportional gain. An integrator is supposed to run off to the power supply rails if the integral of the input is not within range. If you are trying to test it with out the microscope actually servoing this can be very difficult. The first test I would do is put a junk sample something you don't care if a tip jabs into it such as a piece of scrap metal such as copper or steel but not aluminum the oxide is very insulating. Make a tip by cutting a copper wire. Adjust the approach screws so the tip is near the surface. Turn on the electronics adjust the integral gain to its maximum setting, this is when the variable resistor is set to 0. Note the error signal and the output of the integrator. Carefully bring the tip into contact with the sample. You might here a squeal from the piezo disk the tip touches the sample. This is the servo going into oscillation. Again note the error voltage. If you are trying to servo the tip and the tips is touching the sample there is a possibility that the piezo is the reverse polarization of the one I am using. One clue that this might be happening is that the servo voltage will just go from one rail to the other with little oscillation, even if the servo gain is at the maximum. If the output voltage of the servo is not changing, it might be that the sample bias is not the opposite polarity of the set point voltage.

The other possibility is that the coarse mechanical approach is too coarse, such that you can't position the sample within the range of motion of the piezo (about 0.003mm in Z). On my microscope I use UNF #2-56 screws (about 0.454mm pitch thread) for the coarse positioning with the back screw s motion being reduced down by a lever, by a factor of 1/70. One turn of the back screw results in about 0.006mm motion in Z. so there is less than one half turn of the back screw to cover the whole Z range of the piezo.

If the mechanism is a little loose it can also behave the same way. I placed several rubber bands around my microscope to hold the two halves together more tightly to reduce this problem.

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