

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Electrical Engineering

6.331 Advanced Circuit Techniques

Design Problem 3  
A/D Converter

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Design any one of the following A/D converters:

**High-Accuracy Circuit:** 12 bits, 1 second conversion time. You may not use any technique (successive approximation or otherwise) which places a D/A in a feedback loop to perform the A/D function.

**High-Speed Circuit:** 10 bits, 10  $\mu$ s conversion time. Because we anticipate a more substantial design effort than simply connecting a single chip to a high speed D/A, you may not use a successive approximation technique for this design.

**Low-Power Circuit:** 10 bits, 0.1 second conversion time, absolute minimum power consumption. Any technique is allowed for this design. To compute the power consumption, assume that a conversion is performed every 0.1 second.

Common Specifications:

- Power Supplies:  $\pm 15$  volts, with an accuracy of  $\pm 0.5$  volt.
- Temperature:  $25^\circ \pm 10^\circ\text{C}$ .
- Input Range: 0 to +10 volts
- Source Impedance: 1 k $\Omega$

The converter is allowed to have periodic auto-calibrating cycles if necessary. You may specify whether or not the user must precede the A/D converter with a sample and hold. In your write-up, analyze the performance of your design with respect to monotonicity, absolute and relative accuracy, the addition of noise on the input, the effects of temperature, and the variations of power supply voltages.

The restrictions on the first two designs is only to encourage thoughtful design and not to discourage the future use of successive approximators. If you have any questions about what is allowed for a design or if you would like to work on a design to a different set of specifications, please talk to one of the staff early in your design effort.