MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering

6.331 Advanced Circuit Techniques

Laboratory 1
50Ω Driver

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Due : Thursday, September 22, 2011

Design, build, and demonstrate an amplifier that can be used as an output stage for a waveform generator. Minimum specifications include:

- Slew rate $\geq$ 10 V/μs
- Small-signal bandwidth $\geq$2 MHz
- Less than 10% overshoot in response to a small step input
- Output resistance = 50Ω
- Ability to drive a 50Ω load (or cable) to at least ±5 volts
- Capacitive load of 20 to 50 pF
- Can withstand output shorts to ground. (If you feel ambitious, design to survive output shorts to ±15V.)
- Gain adjustable from 0–10. (A gain of 10 preceded by a variable attenuator is fine.) This is the unloaded gain, with 50Ω load the gain is 0–5.
- No DC offset from input to output
- Distortion should be less than 10% for all sinewaves up to 1 MHz, but since we have no easy way to measure this in the lab you may just eyeball your waveform for unreasonable distortion.

Parts: you may use LM301 op amps, and whatever discretes you need (2N3904, 2N2219, etc). Suggestions:

1. An LM301A with feed-forward compensation and a discrete output stage. See Operational Amplifiers sections 8.4, 13.3.6, and 13.3.7.
2. A single high gain stage followed by an output stage. An LM301A may be used to provide good low frequency characteristics. High frequency signals are feed-forward coupled around the op amp.
3. A completely discrete component design, either a voltage amp or transimpedance amp topology. Despite the order of suggestions, this is probably the topology which has shown the most consistent success.