The cascode circuit

Charles Small - May 11, 2006

This fortnight's exposition of Design Ideas kicks off with another application of the cascode circuit. An earlier Design Idea used a cascode-connected MOSFET in a boost regulator, while this one proposes that a "JFET cascode boosts current-source performance."

In its vacuum-tube version, the cascode circuit consists of two triodes connected in series, with the lower triode's cathode connected to ground and the upper triode's cathode connected to the lower triode's plate. You apply a signal to the lower triode's grid, ground the upper triode's grid, and extract the output from the upper triode's plate.

So, when did the cascode circuit originate? I first encountered it in an early 1950s-vintage TV receiver's TV tuner, where a cascode-connected 6BQ7 dual-triode RF amplifier provided better fringe-area reception than a 6J6 or 6AK5. The first mention in the Proceedings of the IRE appears as a footnote in an article entitled "Current Stabilizers" (Reference 1, below): "The term 'cascode' as distinguished from 'cascade' applies to an amplifier in which the tubes are connected in series to obtain direct coupling."

A later article (Reference 2) claims invention by the authors in MIT's Radiation Laboratory in 1944 and a somewhat similar circuit published in 1941 (Reference 3). My hunch is that an unsung experimenter stumbled across the circuit in the 1930s but never published the design. Good circuits have a way of getting rediscovered.

Our second Design Idea offering, "Microcontroller delivers voltage-multiplied dc power," describes how you can combine uncommitted portions of a Cypress Semiconductor PSoC and a Villard Cascade voltage multiplier to tease extra volts at low current out of a low-voltage source. Keep this approach in mind if you need bias for an LCD display, or power for an analog something. While you're at it, take a look at the Marx Generator and the Fitch circuit, too.

Our final offering, "Low-dropout linear regulators deliver constant currents," shows how to use an LDO voltage regulator to stabilize current. If you search EDN's web site using the expression "constant-current", you'll receive close to 600 matches that cover the gamut from LED illumination to current-loop energization. Unfortunately, at the moment I can't recall any current-source circuits that bear the names of their designers, so here's a chance for you to immortalize your creation.

Finally, if you haven't followed the discussion about Network Neutrality, you might want to do so. The link above offers a relatively dispassionate review of the law currently before the United States Congress that would allow preferential treatment of certain types of Internet traffic. Read as much as you can, make up your mind about the issue (pro or con), and annoy your Congressional representatives.

References:

Until next time...73.

—Brad