



SEMINAR

Room 1035 ETB

November 6, 2017, 1:50 – 2:50 P.M.

An Output-Compensated Three-Stage Amplifier Capable of Driving Ultra Large Capacitive Loads

by

Joseph Riad
Texas A&M University

Abstract: With the aggressive scaling of supply voltages and transistor dimensions, intrinsic device gains are dropping but the need for high-gain amplifiers still exists. Since cascode configurations are no longer viable in low-voltage settings, the trend is to use cascaded (multi-stage) amplifiers. For applications such as low-dropout (LDO) linear regulators and active matrix LCD displays, high-gain amplifiers are required to drive increasingly large capacitive loads (in the nF range). Most existing topologies rely on Miller capacitors which tend to be bulky and to slow down the amplifier considerably. In this work, a new compensation strategy is proposed whereby a multi-stage amplifier can be made output-compensated, thereby requiring no Miller capacitance while being able to drive a wide range of load capacitances. Two different compensation approaches are explored and analyzed in detail and it is demonstrated that one approach is clearly superior. The superior approach is used to design and fabricate a three-stage amplifier in standard 0.13 μm CMOS technology. The fabricated amplifier is able to drive loads from 360 pF – 50 nF ($\sim 139\times$) using three discrete modes. The amplifier is power-scalable depending on the expected capacitive load range, with a maximum power consumption of 186.5 μW from a 1 V supply. Comparison with state-of-the-art amplifiers shows that the amplifier achieves superior small-signal performance and competitive large-signal performance while driving a significantly larger range of capacitive loads.

Bio: Joseph Riad obtained his B.Sc. and M.Sc. in Electronics and Communications Engineering from Ain Shams University, Cairo, Egypt in 2010 and 2014, respectively. Since 2014, he has been with the AMSC group in Texas A&M University to pursue his Ph.D. in Electrical and Computer Engineering under the supervision of Prof. Edgar Sanchez-Sinencio. His research interests include power management, low-voltage multi-stage amplifiers and automatic control of large-scale systems. Joseph Riad obtained his B.Sc. and M.Sc. in Electronics and Communications Engineering from Ain Shams University, Cairo, Egypt in 2010 and 2014, respectively. Since 2014, he has been with the AMSC group in Texas A&M University to pursue his Ph.D. in Electrical and Computer Engineering under the supervision of Prof. Edgar Sanchez-Sinencio. His research interests include power management, low-voltage multi-stage amplifiers and automatic control of large-scale systems.