Structured Amplifier Design in CMOS technology

A systems engineering approach to the design of custom-specific amplifiers in CMOS technology

Table with design techniques and their effect on performance aspects, cost factors, environment, reliability and safety

Design techniques	Performance aspects: Drive capability: Static V-I drive capability	Performance aspects: Drive capability: V-I slew rate	Performance aspects: Noise: SNR	Performance aspects: Port Isolation: PSRR	Performance aspects: Port Isolation: CMRR	Performance aspects: Transfer quality: Gain and port impedances	Performance aspects: Transfer quality: Accuracy	Performance aspects: Transfer quality: Offset	Performance aspects: Transfer quality: Weak nonlinearity	Performance aspects: Transfer quality: Small-signal bandwidth	Performance aspects: Transfer quality: Frequency response	Performance aspects: Transfer quality: Frequency stability	Performance aspects: Transfer quality: Temperature stability	Cost factors: Electrical resources: Quiescent dissipation	Cost factors: Electrical resources: Power efficiency	Cost factors: Mechanical resources: Dimensions	Cost factors: Mechanical resources: Mass	Environment: From environment: Temperature	Environment: From environment: Mechnical conditions	Environment: From environment: Electrical conditions	Environment: To environment: Temperature rise	Environment: To environment: Emitted noise	Environment: To environment: Waste	Reliability: MTTF	Reliability: MTBF	Reliability: MTTR	Safety: User	Safety: Environment	Safety: Product
Device: Geometry			■		■								■		■		■							■					■
Device: Operating current		■		■		■		■		■		■		■		■		■		■			■		■		■		
Device: Operating voltage	■		■		■		■		■		■		■		■		■				■			■					■
Feedback: Direct negative feedback		■																											
Feedback: Indirect (model-based) negative feedback	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Feedback: Direct positive feedback		■																											
Feedback: Indirect (model-based) positive feedback				■		■		■		■		■		■		■		■		■		■		■		■		■	
Feedback: Increase DC or mid-band loop gain		■																											
Feedback: Increase loop gain-poles product	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Feedback: Decrease error-gain ratio of the loop gain		■		■		■		■		■		■		■		■		■		■		■		■		■		■	
Error feedforward: Direct		■																											
Error feedforward: Indirect (model-based)	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Balancing: Anti-series connection		■																											
Balancing: Complementary-parallel connection	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Frequency compensation: Phantom-zero compensation		■																											
Frequency compensation: Pole-splitting (feedback)				■		■		■		■		■		■		■		■		■		■		■		■		■	
Frequency compensation: Pole-splitting PZ canceling	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Frequency compensation: Resistive broadbanding		■																											
Frequency compensation: Bandwidth reduction				■		■		■		■		■		■		■		■		■		■		■		■		■	
Impedance correction: Brute-force port termination	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Impedance correction: Zobel correction		■																											
Impedance transformation: At the source		■																											
Impedance transformation: At the load	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Modulation: Frequency shift		■																											
Modulation: Bandwidh - Power	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Auto-zero: Time multiplex		■																											
Auto-zero: Time-space multiplex	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■
Filtering: Electrical		■																											
Filtering: Mechanical				■		■		■		■		■		■		■		■		■		■		■		■		■	
Filtering: Thermal	■		■		■		■		■		■		■		■		■		■		■		■		■		■		■

End terms

After following this course you are able to:

1. Indicate strong positive interactions and strong negative interactions between:
   the design techniques in the rows and the performance aspects, cost factors,
   and environmental conditions in the columns.

2. For the strong positive interactions:
   - Describe how the design technique improves the performance aspect, reduces the
     costs, or reduces the susceptibility to environmental influences.
   - Give examples that elucidate the above.

3. For the strong negative interactions:
   - Describe how the design technique adversely affects the performance aspect,
     or increases the costs or the susceptibility to environmental influences.
   - Give examples that elucidate the above.

The above concerns the blue items only.