ACD – FORMULARIO

**ANALOG STAGE DESIGN**

MOSFET PARAMETERS

*Ohmic Current:*

*Saturation Current:*

*Small Signal Parameters:*

*Source Resistance:*

*Drain Resistance:*

*Moderate/Weak Inversion:*

|  |  |  |
| --- | --- | --- |
| *Taxonomy* | *IC values* | *Bias range* |
| *Weak inversion* |  |  |
| *Moderate inversion* |  |  |
| *Strong inversion* |  |  |

*Cut-off Frequency:*

NOISE SOURCES

*Resistor:*

*Mosfet: where in ohmic, in saturation (2 for short ch)*

MOSFET BASIC CONFIGURATIONS

*Common Source:*

*Source Degenerated:*

*Source Follower: if , else*

PROTOTYPICAL DIFFERENTIAL STAGE

*With Resistive Load*

*Differential Mode:*

*Common Mode:*

*With Active (Mirror) Load*

*Differential Mode:*

*Common Mode:*

*White Noise:*

*1/f noise:*

*Corner frequency:*

TWO STAGE OTA

*Differential Gain:*

*Compensations*

*Miller Capacitance:*

*# to have stability both the second pole and the positive zero should be moved away from the GBWP, so increasing and reducing the GBWP and the zero that follows it (at least a decade below ), or increasing the transconductance of the second stage, to move the zero away from the GBWP together with the second pole.*

*Nulling Resistor:*

*# if we set the zero is pushed to infinite. Better if we set so that the zero becomes even negative, best solution put to have a cancellation in phase (-90+90). Starting setting to have , then to have the pole-zero compensation.*

*To build for pole-zero compensation with a transistor with and we need to derive from , and if we have .*

*Ahuja Compensation: (if we use a voltage buffer)*

*# for values larger than the load capacitance, the second pole is set by , which is usually much smaller than and . Therefore, the ratio needed to reach a given phase margin can be much lower than the value required in the nulling resistor case, thus leading to lower current consumption.*

*# Finite buffer resistance introduces a left zero and a new HF pole that can become conjugated with the second pole: (if we use a voltage buffer). In the case of Ahuja we can estimate pole positions from expression .*

*Deriving and . This couple of poles degrade the PM of about*

*, being .*

*Cascode Compensation: it has the same poles of Ahuja compensation (being , and it has two opposite zeroes at the same frequency: if not used in Cascoded Mirror compensation.*

*Slew-Rate:*

*# when we have a two stage amplifier, on the positive slope of the output the limit is set by , on the negative one is the minimum between and .*

SINGLE STAGE AMPLIFIERS

*Telescopic cascode amplifier:*

*Folded cascode amplifier:*

CMRR AND OFFSET

*Deterministic Error:*

*Statistical Error:*

*=*

*Voltage Offset:*

*Pelgrom relationship:*

OUTPUT STAGES

**FILTERS DESIGN**

*Selectivity Index:*

*Maximum in-band attenuation:*

*Minimum stop-band attenuation:*

*Discrimination Index:*

*Discrimination Factor:*

BUTTERWORTH FILTERS

*Butterworth Polynomials normalized:*

|  |  |
| --- | --- |
| *N* |  |
| *1* |  |
| *2* |  |
| *3* |  |
| *4* |  |
| *5* |  |
| *6* |  |

*Q values:*

*To derive the order n:*

*To derive the cut-off frequency: (where and normalized as well)*

CHEBYSHEV FILTERS

*Type-1 filters: where are the Chebyshev polynomials and is a coefficient to*

*have for odd n values or for even values of n*

*To derive the order n:*

*To derive the position of the poles:*

*where*

*Type-2 filters:*

*Elliptical filters:*