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The Folded Cascode OTA**

A folded cascode operational transconductance amplifier (OTA) is a type of amplifier that employs a specific circuit topology to achieve high gain and enhance performance characteristics.

When to Use a Folded Cascode

Folded cascode OTAs are typically used in applications where high gain, wide bandwidth, and low distortion are required. They find use in various analog circuits, including filters, oscillators, and signal processing systems.

DC Gain of Folded Cascode OTA

The DC gain of a folded cascode OTA is given by the equation:

$$A_{DC} = g_{m1} * (g_{m3} * r_{o2} * r_{o4})$$

where:

- g_{m1} is the transconductance of the input stage
- g_{m3} is the transconductance of the folded cascode stage
- r_{o2} is the output resistance of the input stage
- r_{o4} is the output resistance of the folded cascode stage

Why is it Called Folded Cascode?

The "folded" in folded cascode refers to the way the two transistors in the cascode stage are connected. The emitter of Q3 is connected to the collector of Q4, effectively "folding" the circuit onto itself.

Cascade vs. Cascode

Cascade and cascode are different amplifier configurations. In a cascade amplifier, the stages are connected in series, while in a cascode amplifier, the input stage is connected to the output stage in a way that increases the output resistance and gain.

Gain of a Folded Cascode Opamp

The gain of a folded cascode opamp is determined by the equation:

$$A = -g_{m1} * (g_{m3} * r_{o2} * r_{o4})$$

where the symbols have the same meanings as in the DC gain equation.

Increasing Gain in Folded Cascode

The gain of a folded cascode can be increased by:

- Increasing the transconductance of the input stage (g_{m1})
- Increasing the transconductance of the folded cascode stage (g_{m3})
- Increasing the output resistance of the input stage (r_{o2})
- Increasing the output resistance of the folded cascode stage (r_{o4})

Cascode Amplifier

A cascode amplifier is a type of amplifier that uses a cascode connection to increase the output resistance and gain. It is commonly used in RF circuits and audio applications.

Gain Boosting in Cascode

Gain boosting in a cascode amplifier refers to the increase in gain achieved by connecting the emitter of the lower transistor directly to the collector of the upper transistor. This effectively increases the output resistance and, therefore, the gain.

Folded Cascode Structure

The folded cascode structure refers to the specific circuit topology used in a folded cascode OTA. It involves folding the two transistors in the cascode stage to reduce the overall size and improve performance.

Telescopic vs. Folded Cascode Amplifier

Telescopic and folded cascode amplifiers are both high-gain amplifier topologies. The main difference is that in a telescopic amplifier, the input and output stages are in series, while in a folded cascode amplifier, they are partially in parallel.

Poles and Zeros of Folded Cascode

The poles and zeros of a folded cascode amplifier are important in determining its frequency response. The poles represent the frequencies at which the gain drops by 3dB, while the zeros represent the frequencies at which the phase shift is 0 degrees.

Increasing Gain of Cascode Amplifier

The gain of a cascode amplifier can be increased by:

- Increasing the bias current of the transistors
- Using transistors with higher gain
- Reducing the load resistance
- Using a negative feedback network

Advantage of Cascode

The main advantage of a cascode amplifier is its high output resistance, which results in increased gain and reduced output distortion.

Characteristics of Cascode Amplifier

- High output resistance
- Wide bandwidth
- High gain

- Low distortion
- Improved linearity

Difference Between Cascade and Cascode Connection

In a cascade connection, the stages are connected in series, with the output of one stage directly connected to the input of the next. In a cascode connection, the input stage is connected to the output stage in a way that increases the output resistance and gain.

Purpose of Cascode

The purpose of a cascode is to increase the output resistance and gain of an amplifier while maintaining a wide bandwidth and low distortion.

Example of a Folded Structure

A folded structure is commonly used in origami, where a sheet of paper is folded multiple times to create three-dimensional shapes.

Is Cascode Parallel or Series?

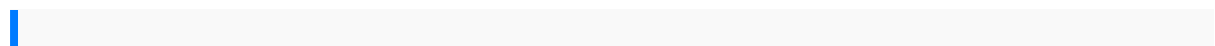
A cascode connection is a hybrid of both parallel and series configurations. The input stage is connected to the output stage in a parallel-like manner, while the transistors within each stage are connected in series.

Advantage of Cascade Amplifier

The main advantage of a cascade amplifier is its simplicity and ease of design. It is also more stable than a cascode amplifier.

Most Preferred Configuration for Cascade Amplifiers

The common-emitter configuration is the most preferred configuration for cascade amplifiers due to its high gain and low output resistance.



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