

# **Structured Electronic Design**

Two-step design of negative feedback amplifiers

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# Two-step design method

Feedback amplifier comprises:

Feedback network(s)

Fixes ideal value(s) of the amplifier's transmission-1 matrix parameter(s)

Controller(s)

Minimizes error between ideal and actual value of the amplifier's transmission-1 matrix parameter(s)

Two-step design:

1. Design of feedback network(s) using nullors as controller(s)
2. Design of controller(s)

Budgets for processing errors should be split:

Contributions of feedback network(s)

Contributions of controller

# Performance limitations affected by the feedback network

## Noise performance of the amplifier

Passive feedback networks enlarge contribution of controller noise to total amplifier noise

Dissipative feedback networks contribute to amplifier noise

## Power efficiency of the amplifier

Passive feedback networks enlarge power losses of the controller

Dissipative feedback networks dissipate power themselves

## Frequency response

poles / zeros in transfer of feedback network become zero / poles in the amplifier's transfer

## Nonlinearity

nonlinear in transfer of feedback network becomes inverse nonlinear transfer of the amplifier

## Temperature stability and ageing

Changes in transfer feedback networks results in changes of the amplifier's transfer

# Contribution controller performance limitations to those of amplifier

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In which way, and to what extent do performance limitations of the controller contribute to performance limitations of the amplifier?

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To study this we need an appropriate feedback model!

This model should describe the transfer as the product of the ideal transfer (controller(s) == nullors) and a function that shows the influence of the controller performance limitations.

# Type of limitations that should be covered by the model

Controller performance limitations that are reduced by feedback:

Yes

Gain inaccuracy / drift  
Bandwidth limitations  
Weak nonlinearity



Error-reduction capabilities  
of negative feedback

No

Noise contribution of controller  
V/I drive capability of controller (clipping)  
Biasing and offset errors of controller

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Influence of parasitic impedances between  
controller terminal and ground