Principle of Amplification

Modulation of power transfer from power source to the load by the signal source

Principle of Biasing

Add power sources such as to obtain the best possible approximation of a linear transfer.
- Input \( v-i \) characteristic passes through the origin
- Output \( v-i \) characteristic passes through the origin
As a result all transfer characteristics (A, B, C, D) pass through the origin.

Biased CS stage: four possible arrangements

Biasing with power supply and passive elements

Add a power supply voltage and redirect the current sources such that:
Voltage supply source is the only bias source that delivers power (product V and I negative)

Biasing errors

- Transistor characteristics depend on temperature and change over time
- Implementation of bias voltages and currents has limited accuracy
- Remaining errors can be modeled as noise sources
- Design friendly representation with equivalent-input error sources:
  - Equivalent-input offset current
  - Equivalent-input offset voltage

Bias error reduction

- Biasing errors can be kept small through application of error-reduction techniques:
  - Compensation
  - Negative feedback
  - Auto-zero

Small-signal model of a biased stage

Determination of the bias voltages and currents

Two of the four sources can be selected independently
The other two follow from the selected ones and the device equations.
The output port bias sources determine the stage’s drive capability:
- \( \text{VDS} \): maximum negative output voltage excursion
- \( \text{IDS} \): maximum positive output current excursion

Circuit for finding the input port bias quantities for a device and its desired output port operating point