

EE 3113

INTRODUCTION TO RF

CIRCUIT DESIGN

Lecture Notes for A-term 1999

LECTURE 24

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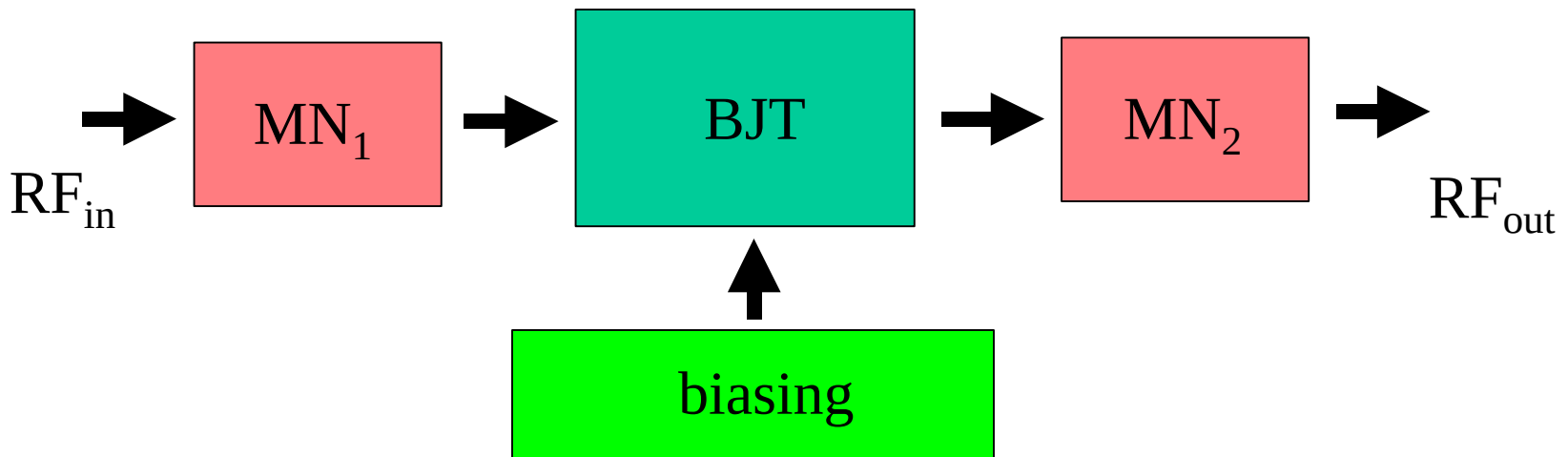
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RF Amplifier

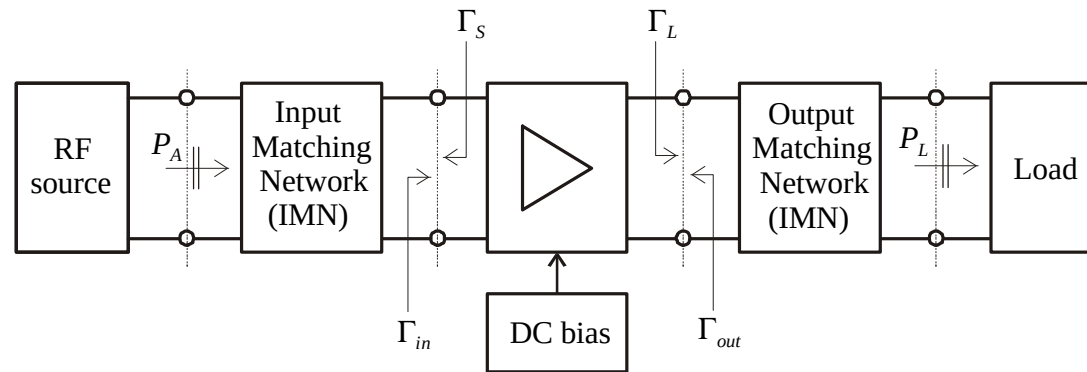
- **Objective:** Design a complete class A, single-stage RF amplifier operated at 1 GHz which includes biasing, matching networks, and RF/DC isolation.



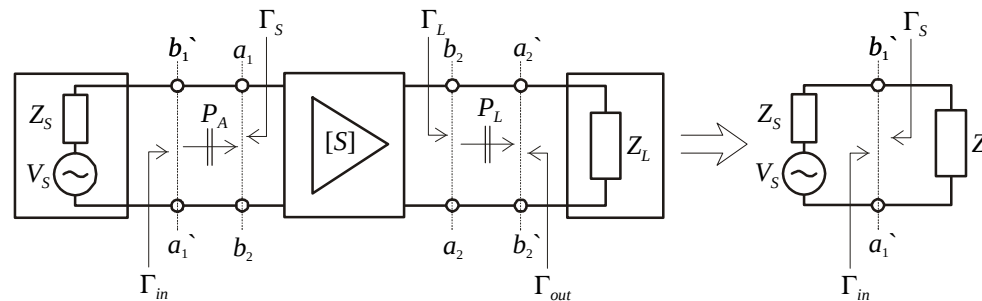
Strategy

- Design DC biasing conditions
- Select S-parameters for given bias and operating frequency
- Build input and output matching networks for desired frequency response
- include RF/DC isolation
- simulate amplifier performance on the computer (Optotek's MMICAD or HP's Libra package)

Overall approach



For power considerations, matching networks are assumed lossless



Power Relations

Transducer Power Gain

$$G_T = \frac{(1 - |\Gamma_L|^2) |S_{21}|^2 (1 - |\Gamma_S|^2)}{|1 - \Gamma_S \Gamma_{in}|^2 |1 - S_{22} \Gamma_L|^2}$$

Available Power Gain ($\Gamma_L = \Gamma_{out}^*$)

$$G_A = \frac{(1 - |\Gamma_S|^2) |S_{21}|^2}{|1 - |\Gamma_{out}|^2| |1 - S_{11} \Gamma_S|^2}$$

Operating Power Gain ($\Gamma_S = \Gamma_{in}^*$)

$$G = \frac{(1 - |\Gamma_L|^2) |S_{21}|^2}{|1 - |\Gamma_{in}|^2| |1 - S_{22} \Gamma_L|^2}$$