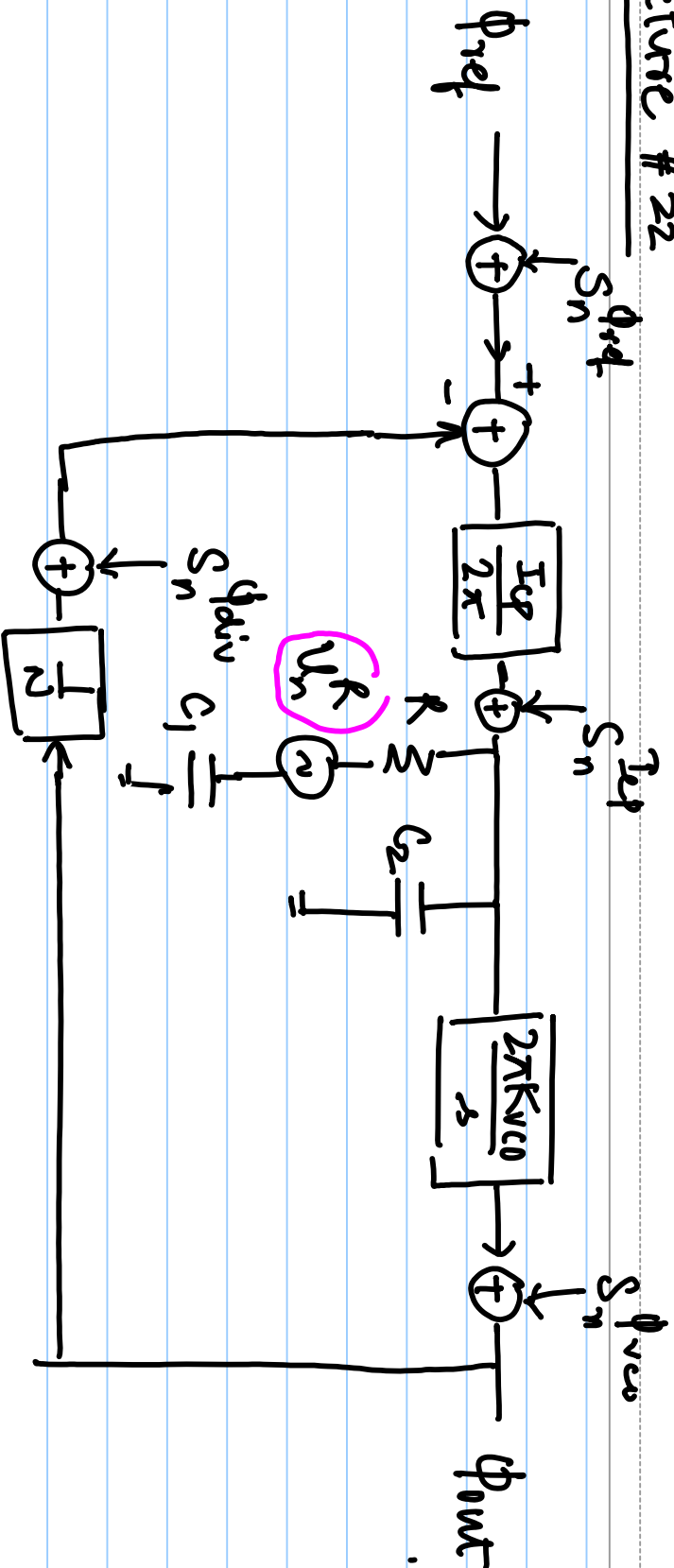
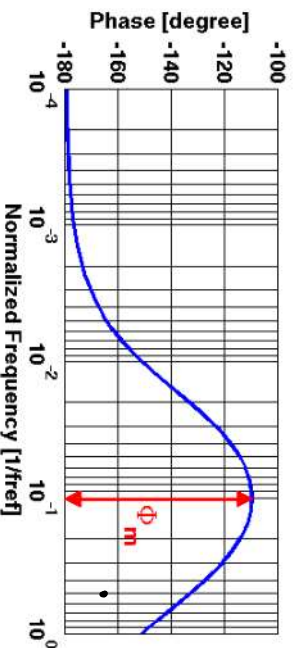
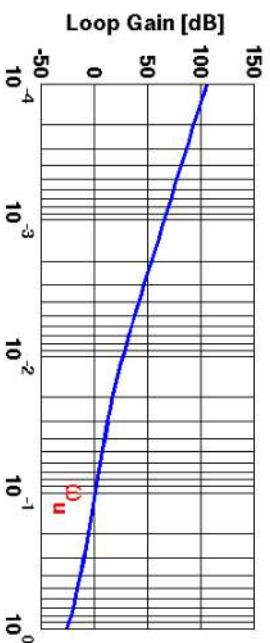
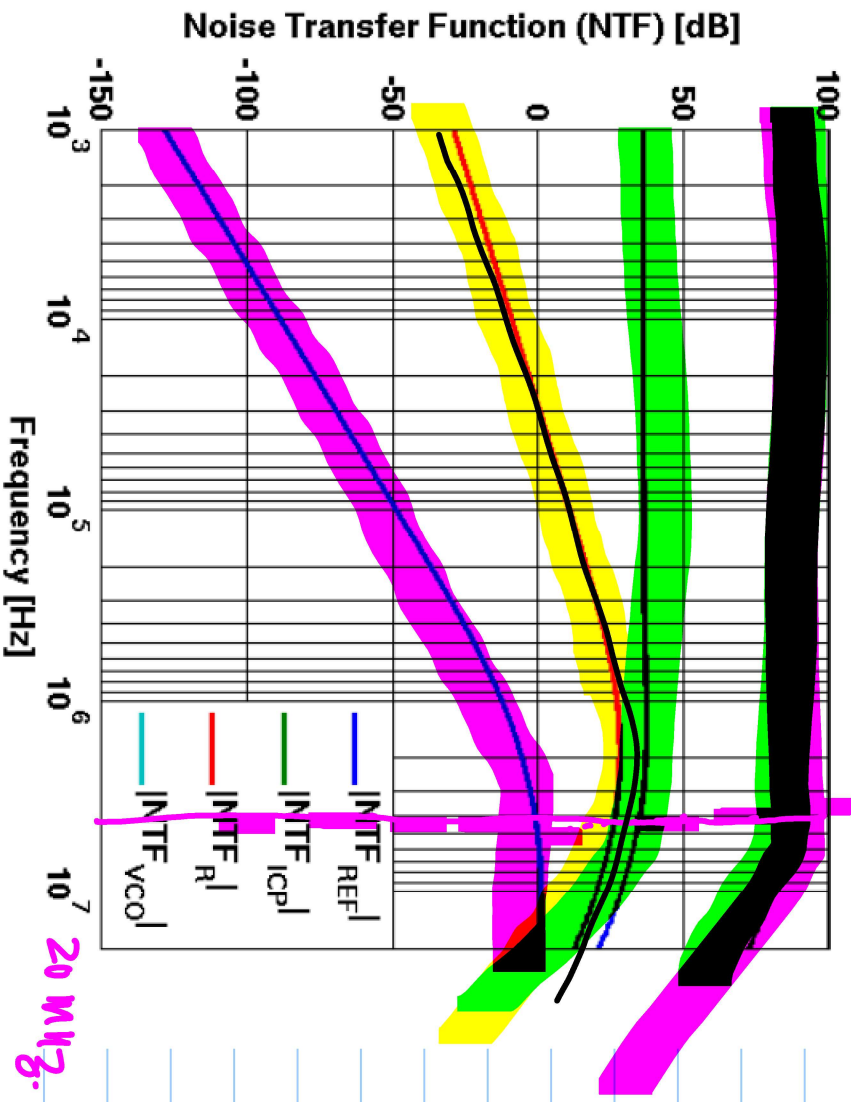


# Lecture # 22



Noise Transfer Function (NTF) =  $\frac{\text{Output Noise}}{\text{Input Noise Source}}$





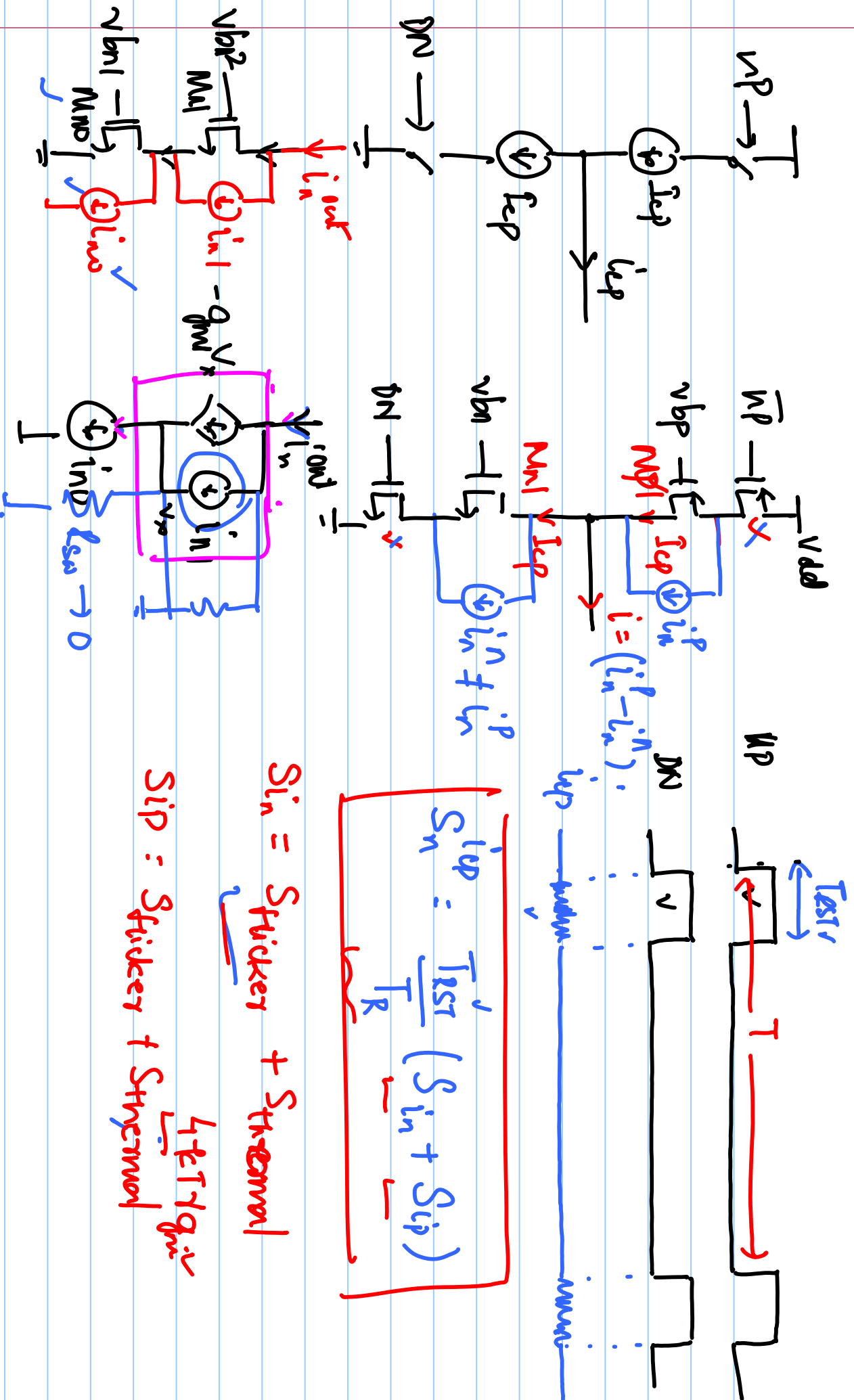
$$NTF_R = \frac{\phi_{out}}{v_n^R}$$

$$S_n^R = 4kTR \left[ \frac{V^2}{Hz} \right]$$

$$\phi_{v_n^R}^{out} = NTF_R \times v_n^R$$

$$S_n^R = \phi_{v_n^R}^{out} = |NTF_R|^2 \times S_n^R$$

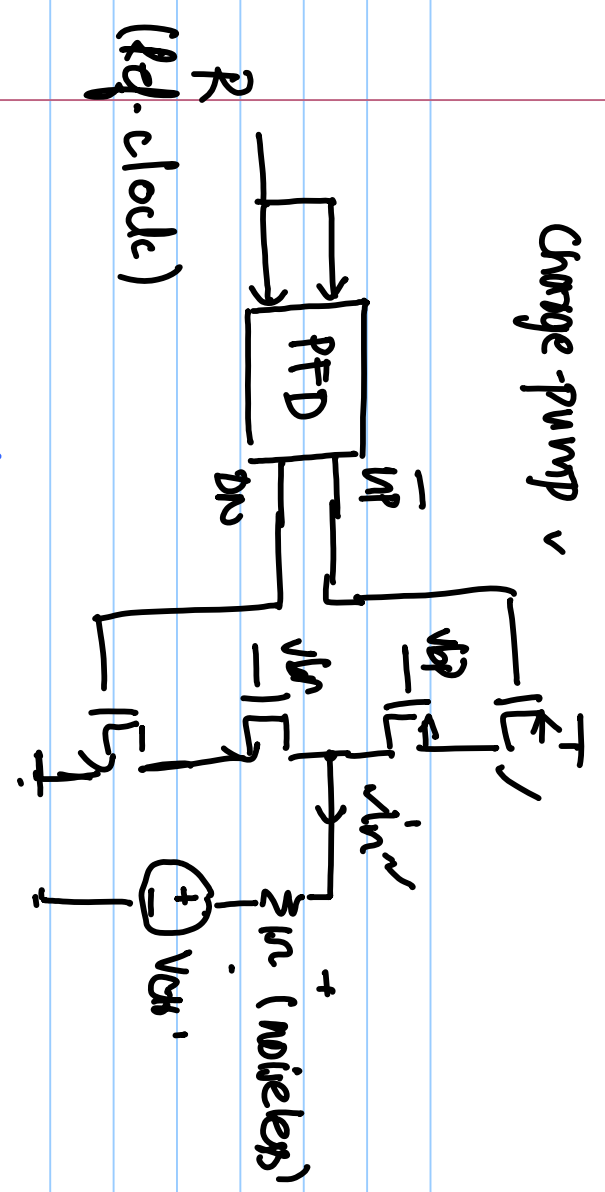
$$= |NTF_R|^2 \times 4kTR$$



$S_{in} = S_{sticker} + S_{streamer}$

$S_{ip} = S_{sticker} + S_{streamer}$   
4 FET  $g_m$

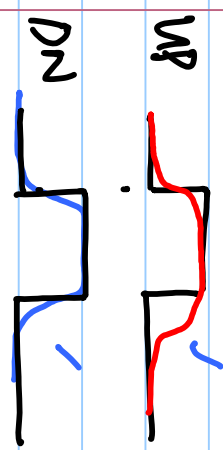
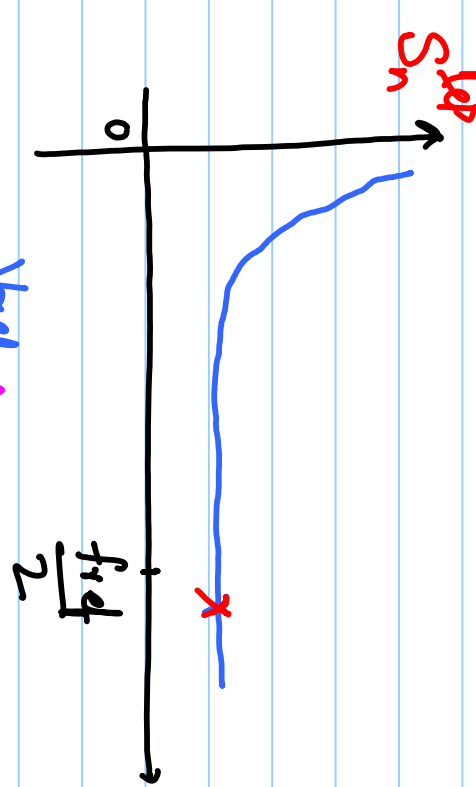
# Charge-pump



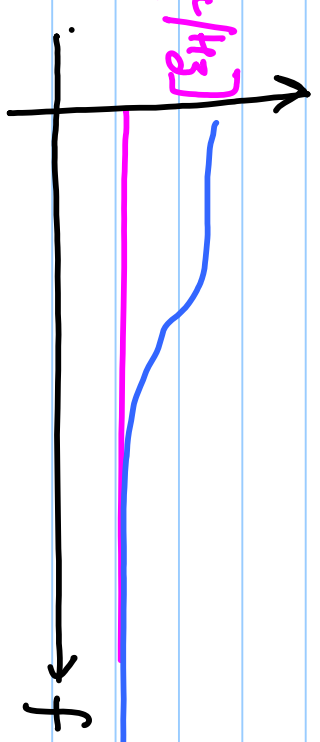
- Periodic Steady State (PSS) An.

(Ref.)

- Noise analysis (PNOISE)



$\phi_{ref}$  noise :

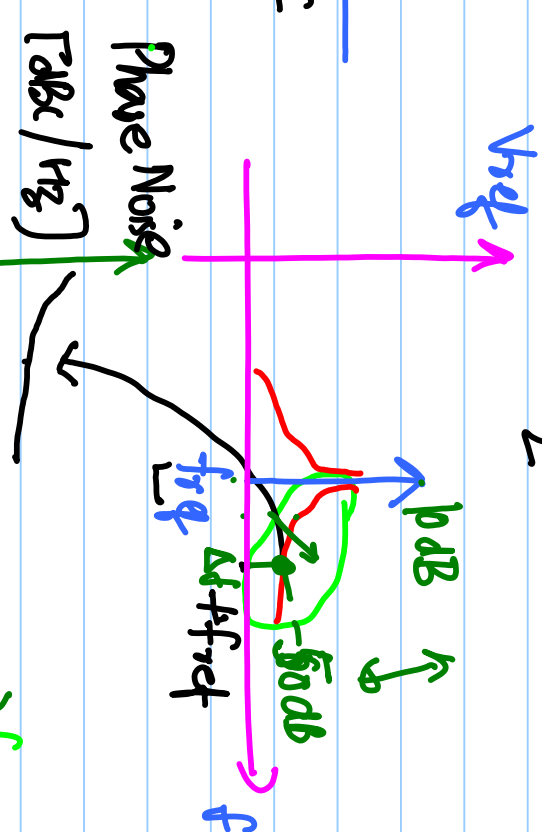


$S_n^{\phi_{ref}}$  [rad<sup>2</sup>/Hz]

[dBc/Hz]

$$S_n^{chrg} = 10 S_n^{\phi_{ref}} (dBc/Hz) / 10$$

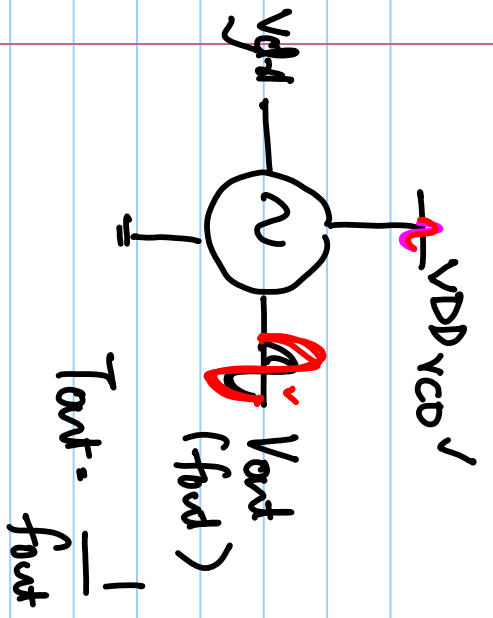
[rad<sup>2</sup>/Hz]



Phase Noise [dBc/Hz]

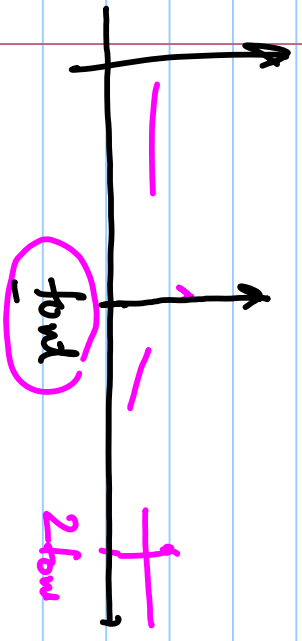
$\Delta f$

b dB  
-50dB  
freq  $\Delta f_{ref}$



— PSS

— PNOISE



### Choosing Analyses -- ADE L (1)

Analysis

- tran
- dc
- ac
- noise
- xf
- sens
- dcmatch
- stb
- pz
- sp
- envip
- pss
- pac
- pstb
- pnoise
- pxl
- psp
- qpss
- qpac
- qpnoise
- qpstf
- qpssp
- hb
- hbac
- hnoise
- hbsp

Engine

- Periodic Steady State Analysis
- Shooting
- Harmonic Balance

Fundamental Tones

#	Name	Expr	Value	Signal	SrcId
X					

Beat Frequency  
 Beat Period

56

Auto Calculate

Output harmonics

Number of harmonics: 5

Accuracy Defaults (errpres) ✓

- conservative
- moderate
- liberal

Additional Time for Stabilization (tstab) 50n

Save Initial Transient Results (saveinit)  no  yes

Oscillator  Oscillator node+ /I

Oscillator node- /IB

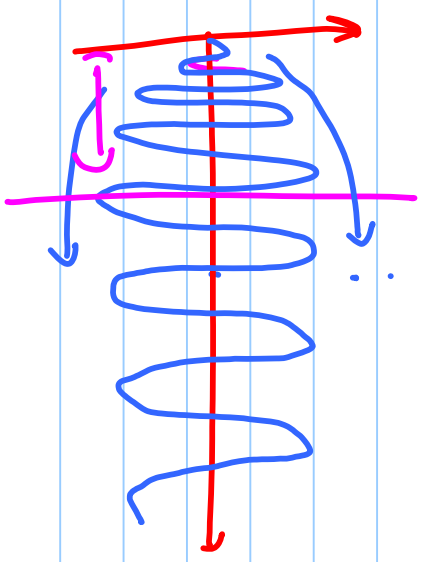
Calculate initial conditions (ic) automatically

Sweep

New Initial Value For Each Point (restart)  no  yes

Loadpull

Enabled



### Choosing Analyses -- ADE L (1)

- tran
- Xf
- pz
- pac
- psp
- qpac
- hbnnoise
- dc
- sens
- sp
- psp
- qpss
- hbnnoise
- ac
- dcmatch
- enuln
- noise
- qpac
- hb
- hbnoise
- hbsp
- noise
- sst
- pss
- pxf
- qpnoise
- hbac

#### Periodic Noise Analysis

PSS Beat Frequency (Hz)

#### Multiple noise

with 56M3

Sweep type

relative

Relative Harmonic

1

Output Frequency Sweep Range (Hz)

Start-Stop

Start

10k

Stop

10

Sweep Type

Logarithmic

Points Per Decade

10

Number of Steps

Add Specific Points

#### Sidebands

Method  default  fullspectrum

Maximum sideband

5

When using shooting engine, default value is 7

Output

voltage

Positive Output Node

/I

Select

Negative Output Node

/IB

Select

Input Source

none

Noise Type sources

sources: single sideband (SSB) noise analysis

Noise Separation

yes: no

separate noise into source and gain

Enabled

Options...

# Direct Plot Form

Plotting Mode

Append

## Analysis

pss  pnoise  tstab

## Function

- Output Noise
- Input Noise
- Noise Figure
- Noise Factor
- NFdsb
- Fdsb
- NFflee
- Fflee
- Phase Noise
- Transfer Function

Loadpull Contour

Add To Outputs

Plot

> Press plot button on this form...

OK

Cancel

Help

Periodic Noise Response

V1

