Revisiting the

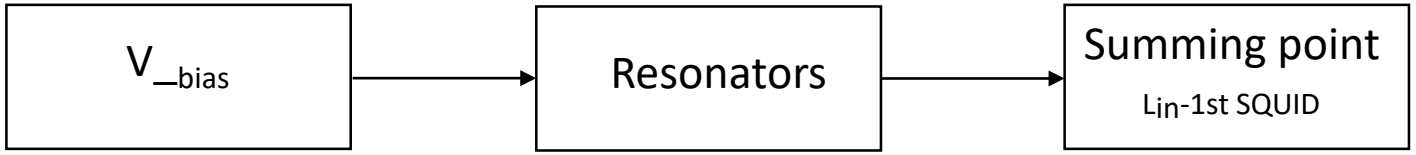
Out of Band Resonances (OBR) of the SAFARI FDM-2-stage SQUID

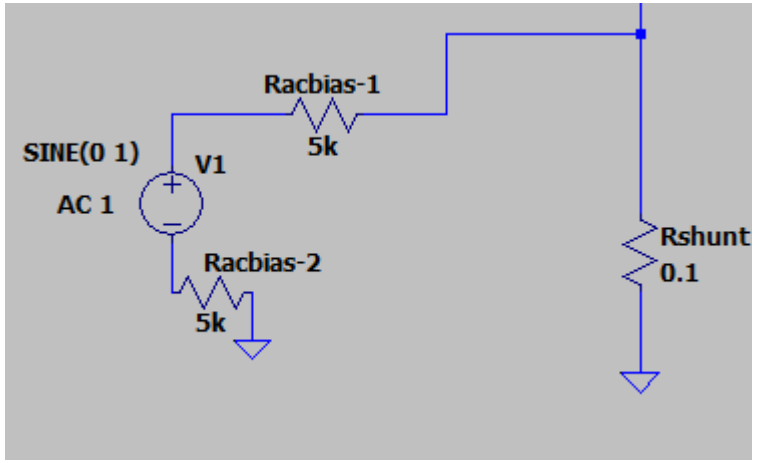
- A SQUID with lower L_{in} shifts away the OBR to the higher frequencies
- The snubber in use still damps down the OBR peak although it can be optimized for the new SQUID
- A nearby OBR could also occur which depends on the Loom-in characteristics. It won't be damped by the snubber at the summing point

Simulation and Modeling using LTspiceXVII

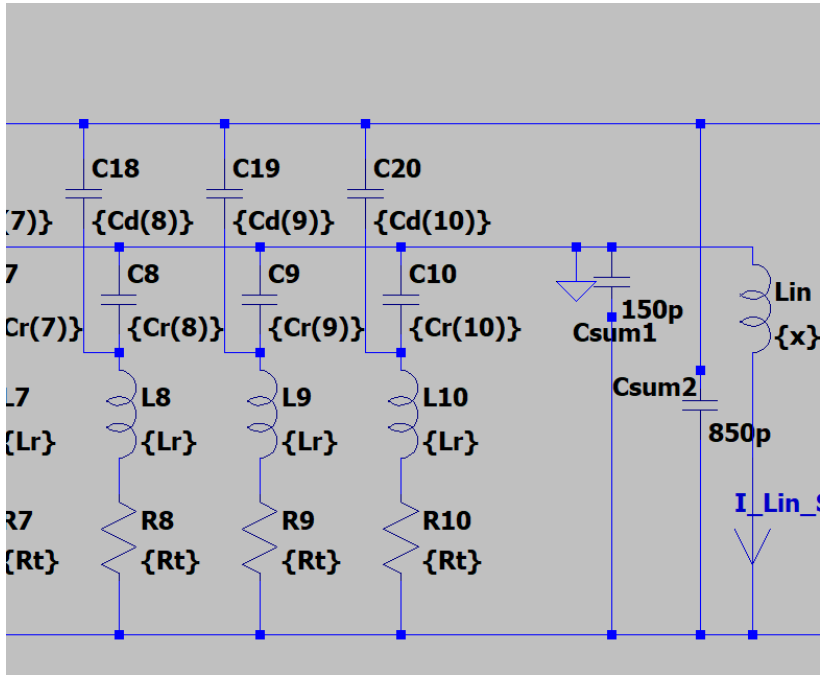
Amin Aminaei, February 2020

Simulation of SAFARI FDM Blocks up to Input of the 1st SQUID

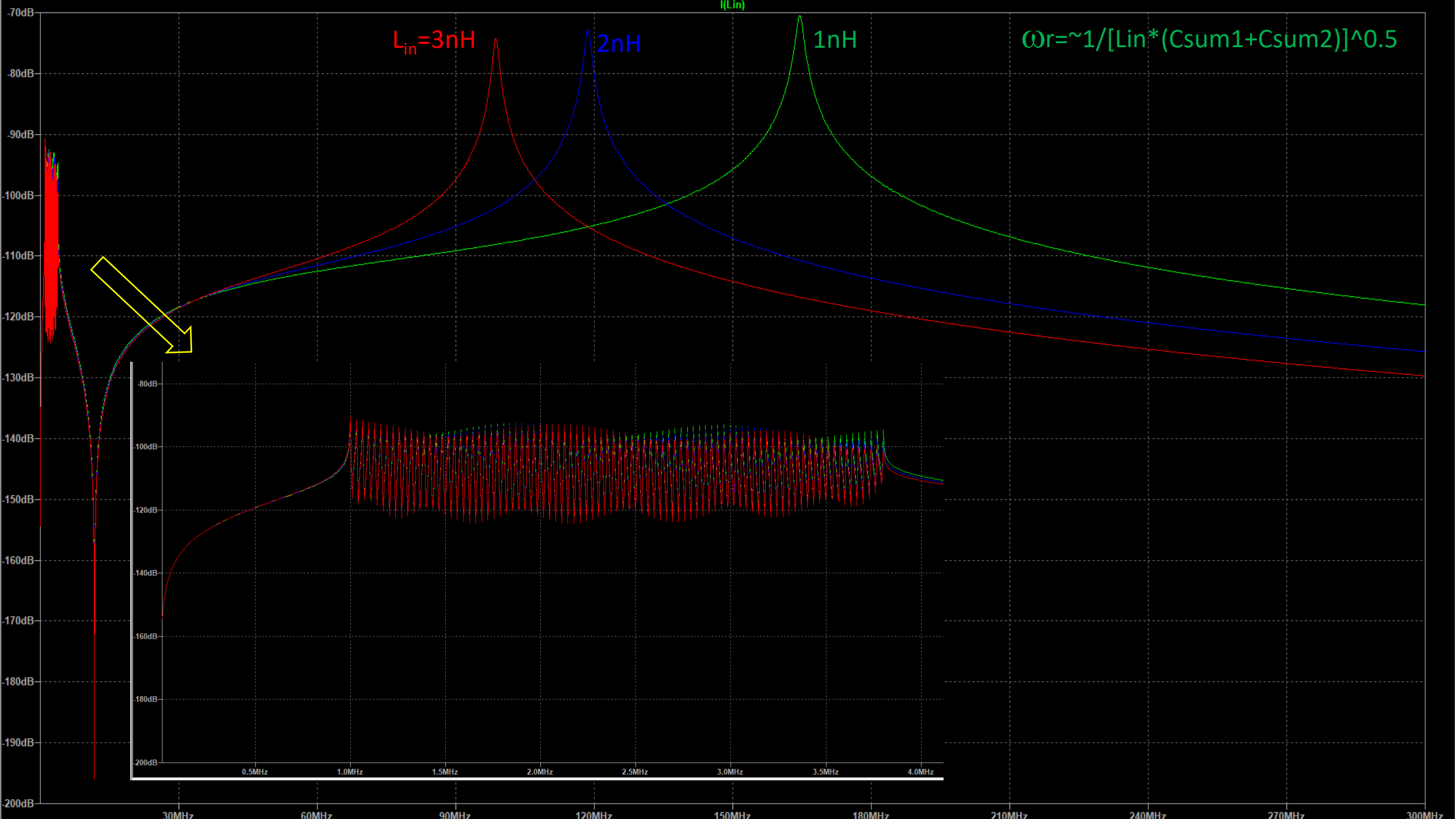




.....88 Pixels(LC's).....



Lin
a. 1nH
b. 2nH
c. 3nH


I(Lin)
L_{in}=3nH
2nH
1nH
ωr=~1/[Lin*(Csum1+Csum2)]^0.5
-70dB
-80dB
-90dB
-100dB
-110dB
-120dB
-130dB
-140dB
-150dB
-160dB
-170dB
-180dB
-190dB
-200dB
30MHz
60MHz
90MHz
120MHz
150MHz
180MHz
210MHz
240MHz
270MHz
300MHz
-80dB
-100dB
-120dB
-140dB
-160dB
-180dB
-200dB
0.5MHz
1.0MHz
1.5MHz
2.0MHz
2.5MHz
3.0MHz
3.5MHz
4.0MHz

I(Lin)

Simulation of the OBR by the snubber in use (2.2 Ohm and 10 nF)

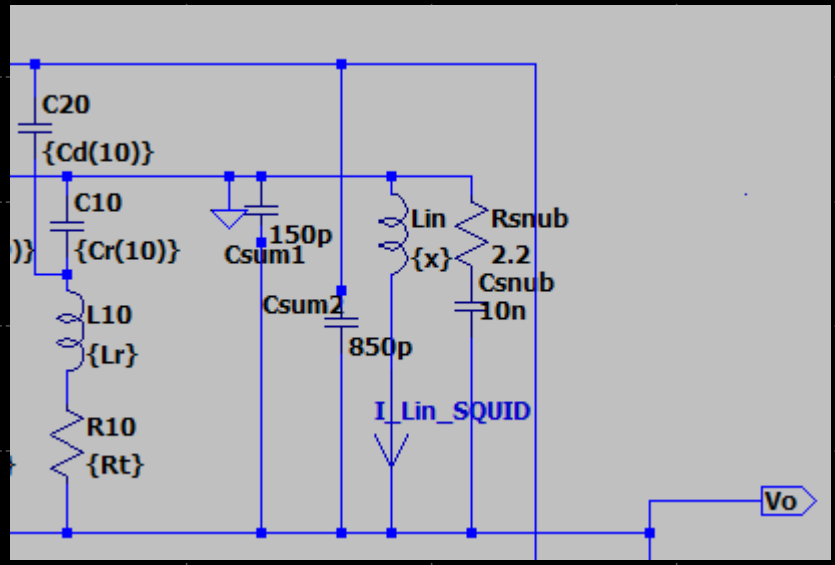
-90dB
-100dB
-110dB
-120dB
-130dB
-140dB
-150dB
-160dB
-170dB
-180dB
-190dB
-200dB

30MHz 60MHz 90MHz 120MHz 150MHz 180MHz 210MHz 240MHz 270MHz 300MHz

1nH

2nH

L_{in}=3nH



Optimized snubber (1.1 Ohm, 10nF) for Lin =1nH & 88LC's

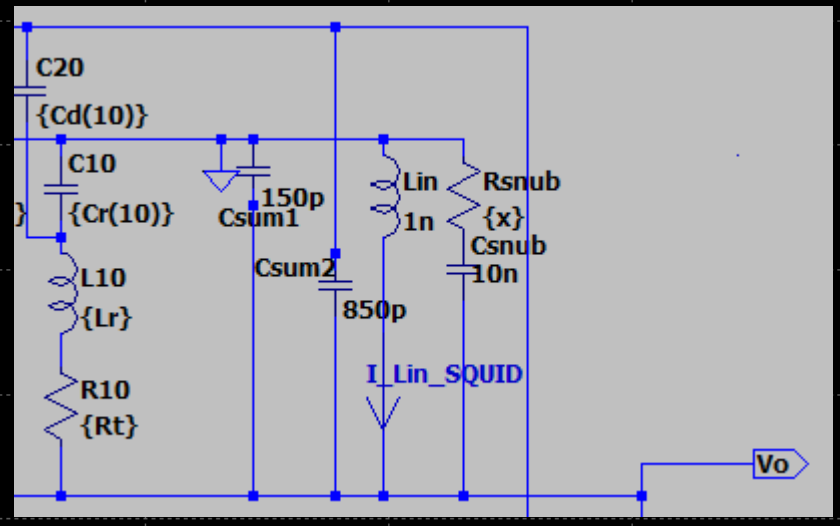
R_{snub}=2.2 Ohm

1.1 Ohm

0.3 Ohm

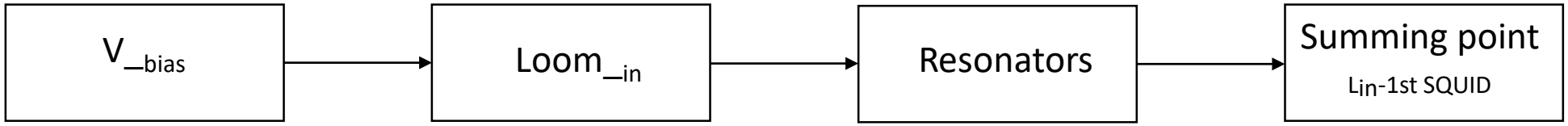
-90dB
-100dB
-110dB
-120dB
-130dB
-140dB
-150dB
-160dB
-170dB
-180dB
-190dB
-200dB

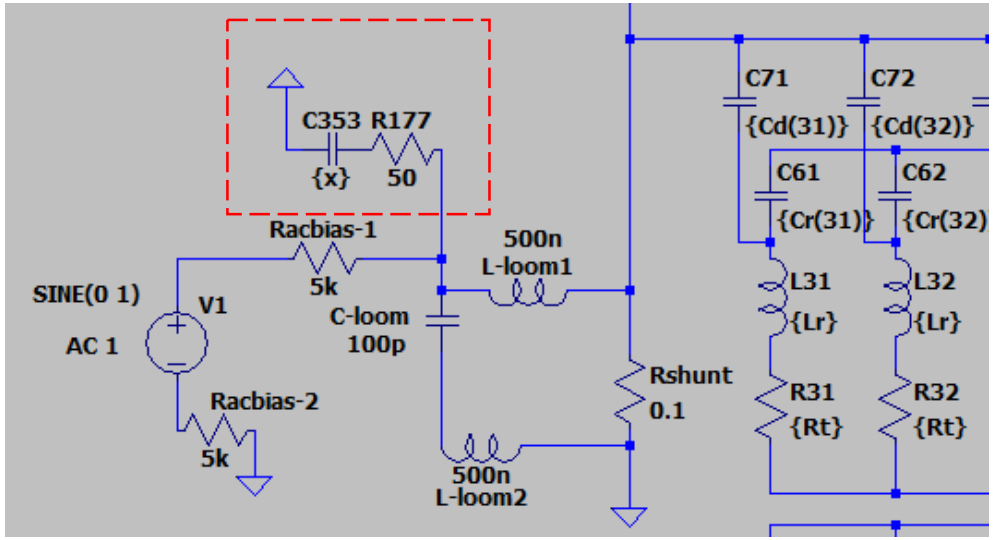
30MHz 60MHz 90MHz 120MHz 150MHz 180MHz 210MHz 240MHz 270MHz 300MHz



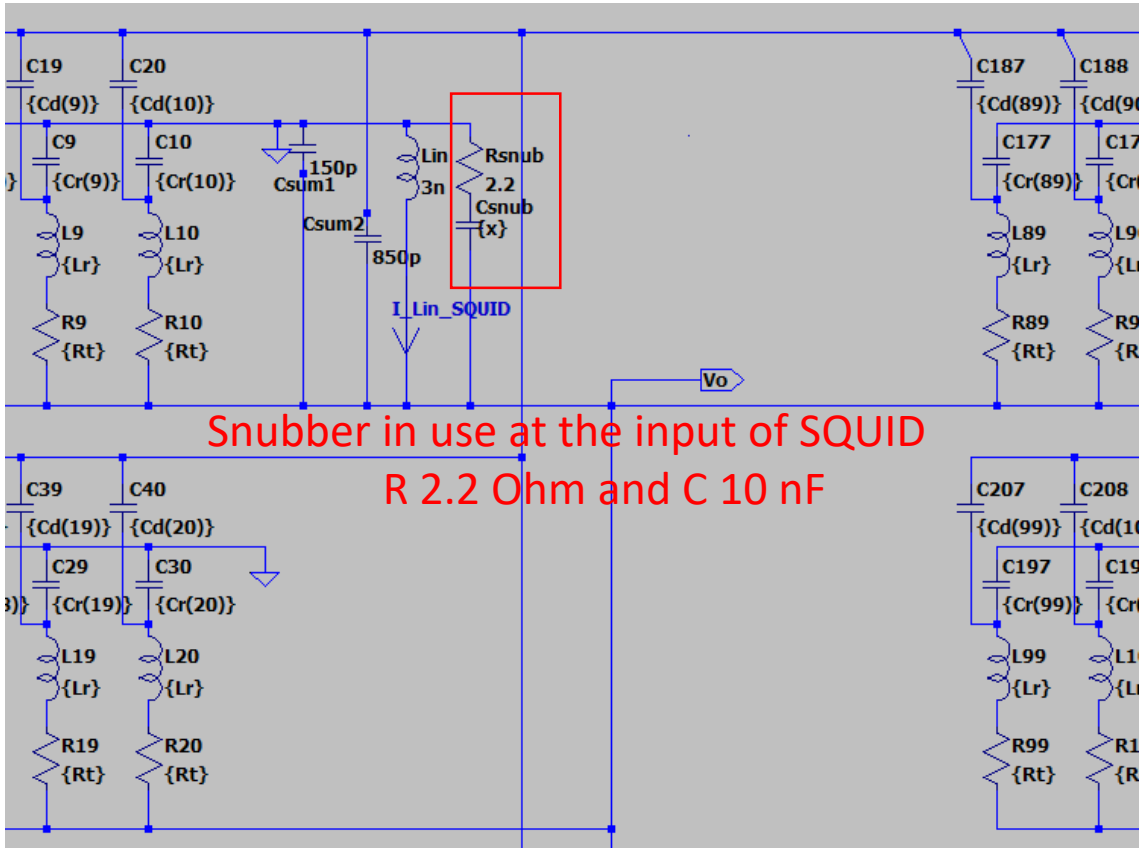
Changing C_{snub} does not make a major difference

The Impact of Loom-$_{in}$

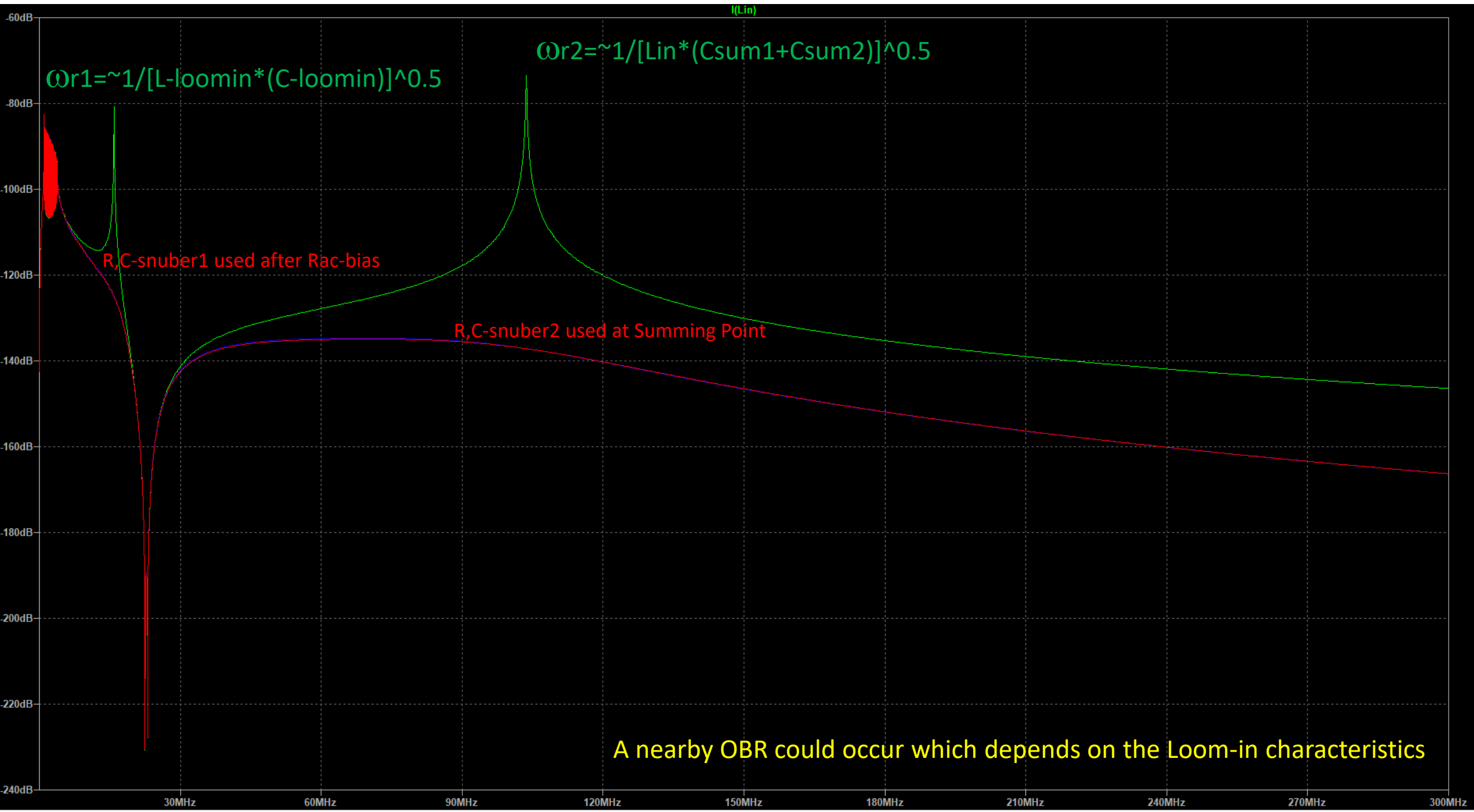




Snubber-1 (Theory) after Rac-bias
Optimal values,R 50 Ohm and C 10 nF



Snubber in use at the input of SQUID
R 2.2 Ohm and C 10 nF


I(Lin)
ωr1=~1/[L-loomin*(C-loomin)]^0.5
ωr2=~1/[Lin*(Csum1+Csum2)]^0.5
R,C-snuber1 used after Rac-bias
R,C-snuber2 used at Summing Point
A nearby OBR could occur which depends on the Loom-in characteristics
-60dB
-80dB
-100dB
-120dB
-140dB
-160dB
-180dB
-200dB
-220dB
-240dB
30MHz
60MHz
90MHz
120MHz
150MHz
180MHz
210MHz
240MHz
270MHz
300MHz