Week2 Announcements and Minute reports FALL 2021

1. **The course learning objectives are such that they require students to work each study week and allocate enough time for the coursework!**

   It is highly recommended to attend the inclass sessions if one seems to be in need of guidance.

2. **Mini-test 1 is mandatory, two alternative sessions Wed 15.9 at 15-17 and Thu 16.9 at 15-17.**
   Sign-up to Mini-test on Moodle! On Moodle: Times for the first Mini-test
3. **As was announced earlier, students need to be present in the light green sessions**

Wk	Mon 14-16	Wed 12-15
1	Intro, demo, objectives of the course (myDAQ+components are given)	Optional inclass, you may work remotely (Multisim and myDAQ basics)
2	Optional inclass, you may work remotely (Measuring impedance with myDAQ)	Optional inclass, you may work remotely (10-kHz phase shifter, tests myDAQ)
3	Optional inclass, you may work remotely (Measuring diode dynamic resistance)	Optional inclass, you may work remotely (Audio amplifiers, tests myDAQ)
4	Virtual Bench (VB) basics	18-MHz amplifier (tests with VB)
5	18-MHz osc. (tests with VB & SA)	18-MHz Amplitude modulator (VB & SA)
6	To be agreed/No inclass (TL and antenna basics)	Antenna Building (tests with VNA)
7	TX building (VB)	TX building (tests with VB & outdoors)

Many had found the Bode plotter trick useful and successfully used the technique!

The phase shifter circuit was a bit unclear why does the phase change from ~0 to ~-180 degrees?

In brief, you could work similarly as with the filter, i.e. consider the response as the frequency approaches 0 or ∞. Lets return to this question when we work with the crystal oscillator in week 5.

Is the phase-shifter primarily meant to be used to correct the phase shift happening in a filter? Or is it meant to act as a filter for a narrow frequency range that just happens to also shift them?

The phase shifters are needed in oscillators to produce 180 degrees phase shift at desired frequency. There is a video available on Oscillator design principles which exemplifies this.

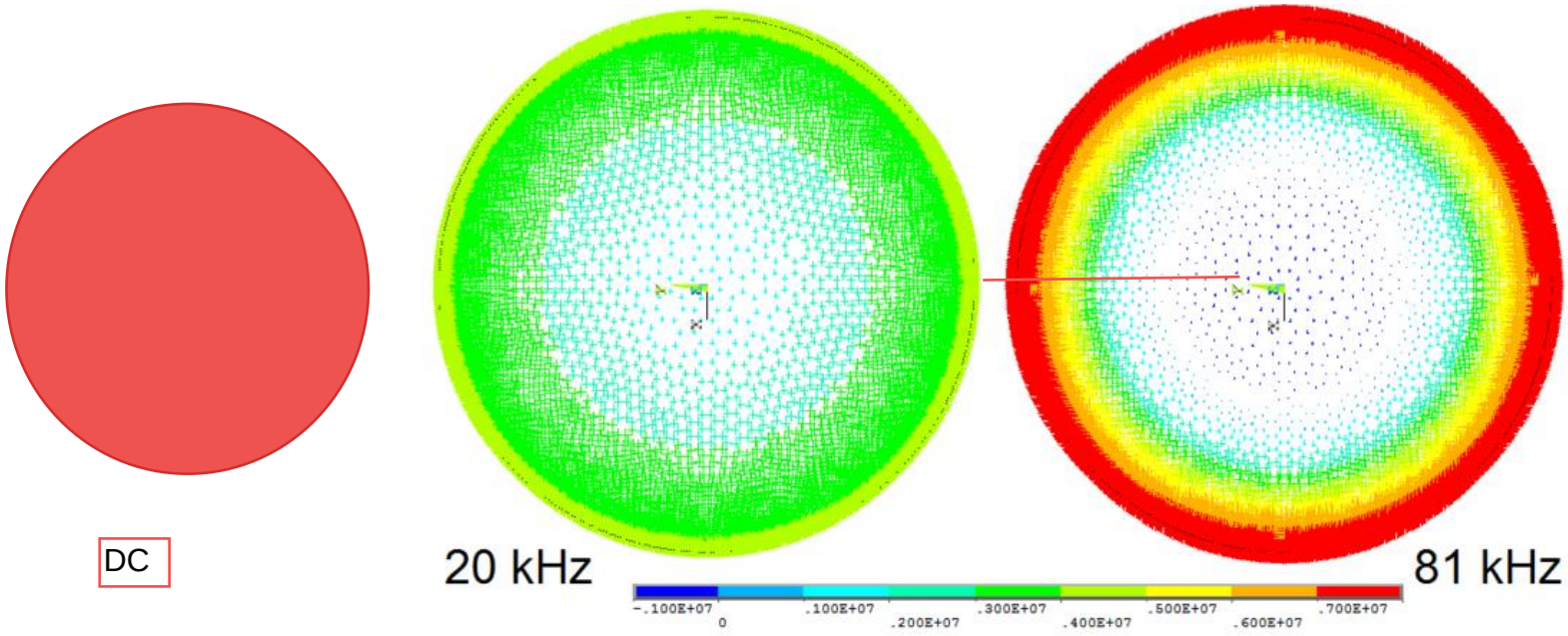
We measured the DC resistance and the RF resistance of the inductor. Why are those resistances not equal? What makes the RF resistance higher?

In brief, one key reason for the the RF or AC resistance being greater is so called skin effect.
Due to the skin effect the current is not distributed as evenly throughout the conductor cross section in AC as in DC

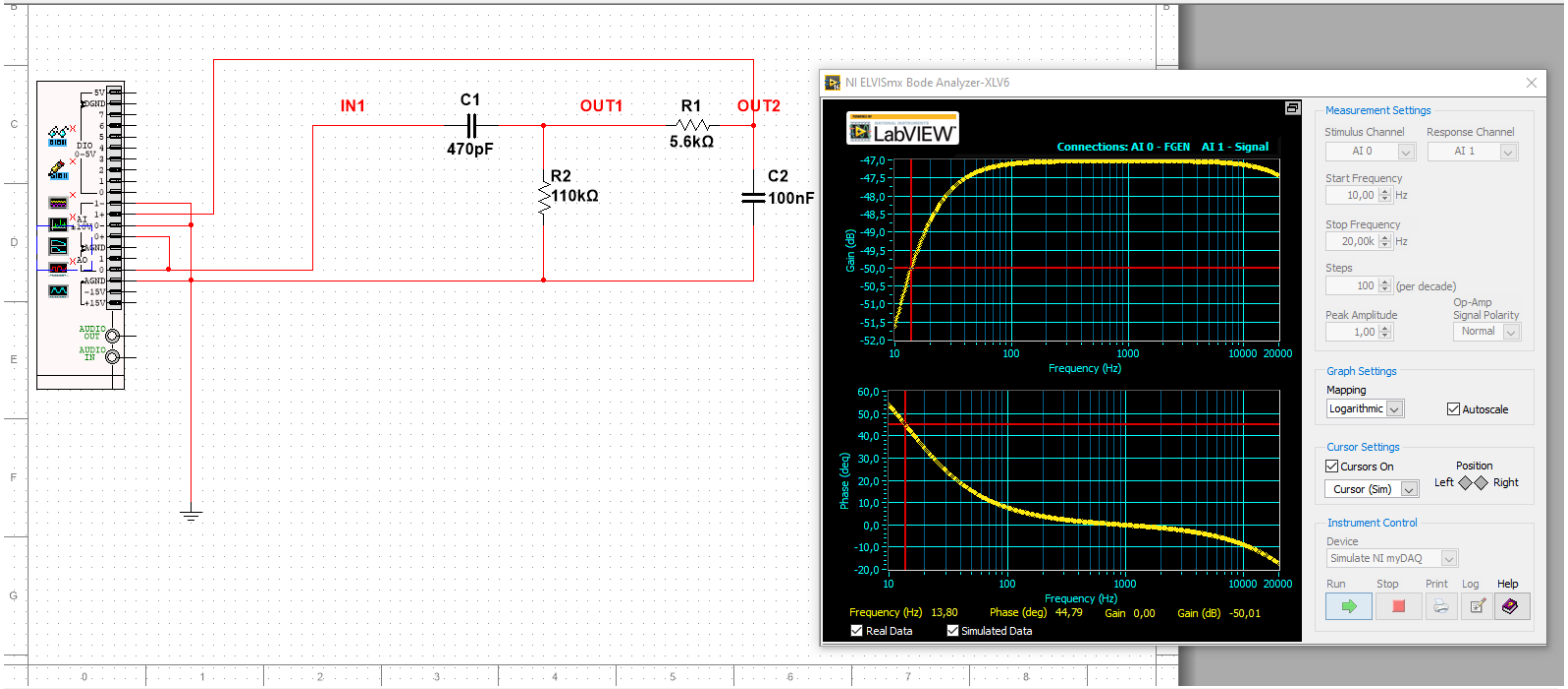
the current density decreases exponentially from the surface towards the inside

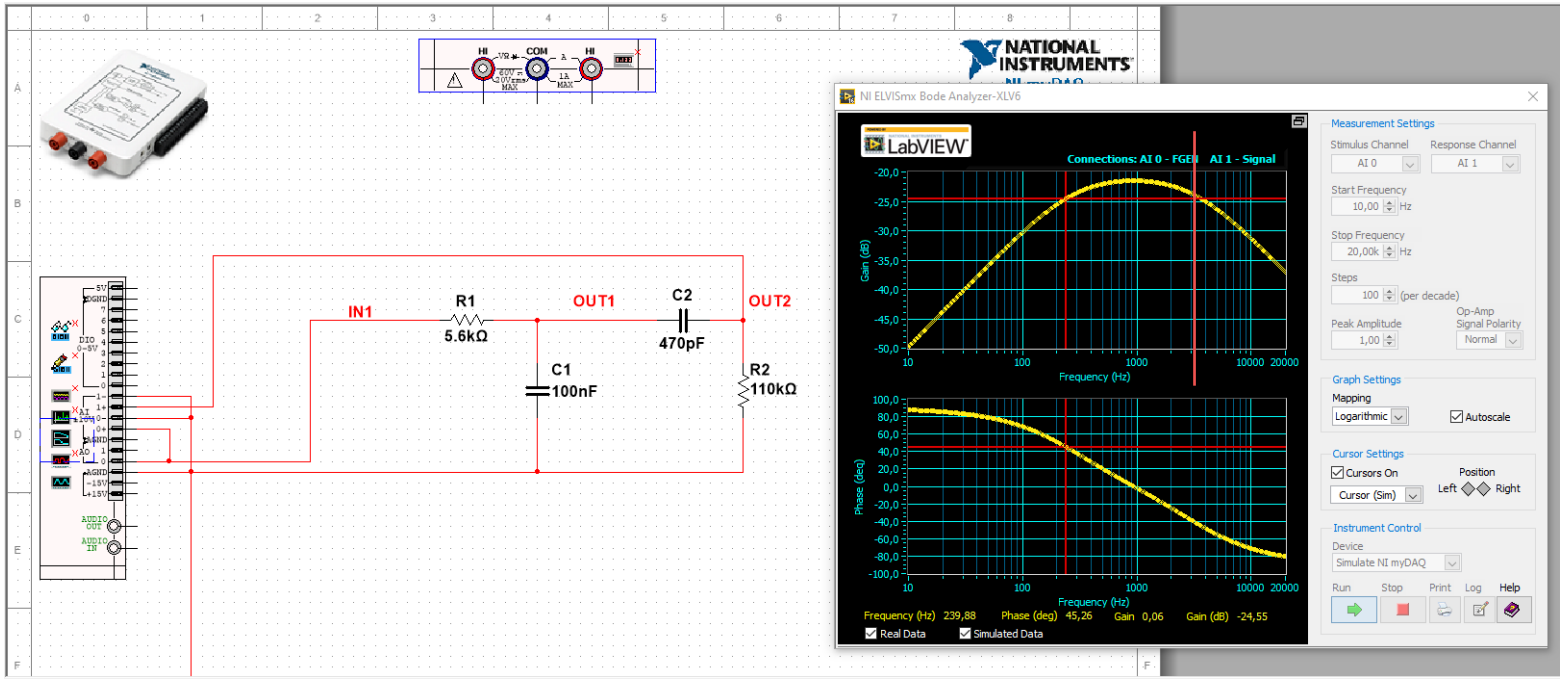
As a result the true cross section in which the current flows is smaller than the physical area which increases the resistance

$R=\rho\ell/A,$



In Monday's optional task 4, there was this bandpass filter simulation. Why did the results vary depending on if we connected LPF to HPF or the other way around? LPF to HPF seems to work (the cutoff frequencies match loosely around theory), but the other way around does not? See attached images: the top image does not match cutoff frequencies at -3 dB (300 Hz and 3 kHz).


IN1
C1
470pF
OUT1
R1
5.6kΩ
OUT2
R2
110kΩ
C2
100nF
NI ELVISmx Bode Analyzer-XLV6
LabVIEW
Connections: AI 0 - FGEN AI 1 - Signal
Gain (dB)
Phase (deg)
Frequency (Hz)
Frequency (Hz) 13,80 Phase (deg) 44,79 Gain 0,00 Gain (dB) -50,01
Real Data
Simulated Data
Measurement Settings
Stimulus Channel
Response Channel
AI 0
AI 1
Start Frequency
10,00 Hz
Stop Frequency
20,00k Hz
Steps
100 (per decade)
Peak Amplitude
1,00
Op-Amp Signal Polarity
Normal
Graph Settings
Mapping
Logarithmic
Autoscale
Cursor Settings
Cursors On
Position
Left Right
Cursor (Sim)
Instrument Control
Device
Simulate NI myDAQ
Run Stop Print Log Help


NATIONAL INSTRUMENTS
IN1
R1
5.6kΩ
OUT1
C2
470pF
OUT2
C1
100nF
R2
110kΩ
NI ELVISmx Bode Analyzer-XLV6
LabVIEW
Connections: AI 0 - FGEN AI 1 - Signal
Gain (dB)
Phase (deg)
Frequency (Hz)
Frequency (Hz) 239,88 Phase (deg) 45,26 Gain 0,06 Gain (dB) -24,55
Real Data
Simulated Data
Measurement Settings
Stimulus Channel
Response Channel
AI 0
AI 1
Start Frequency
10,00 Hz
Stop Frequency
20,00k Hz
Steps
100 (per decade)
Peak Amplitude
1,00
Op-Amp Signal Polarity
Normal
Graph Settings
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