

Assignment: HW 4

Class: ECE 5224

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- Problem 1:
 - DC Resistance:

The screenshot shows the 'DC RL' simulation setup. The 'Simulation' dropdown is set to 'Setup1', 'LastAdaptive' is selected, and 'DC RL' is chosen. The 'Design Variation' field is empty. The 'Profile' tab is active, showing 'Resistance' selected with units 'mOhm', 'Matrix' selected, and '500MHz' selected. 'Inductance' is unchecked with units 'nH', 'Original' is selected, and 'All Freqs' is unchecked. 'Self Terms' is unchecked. The 'View' tab is active, showing a table with the following data:

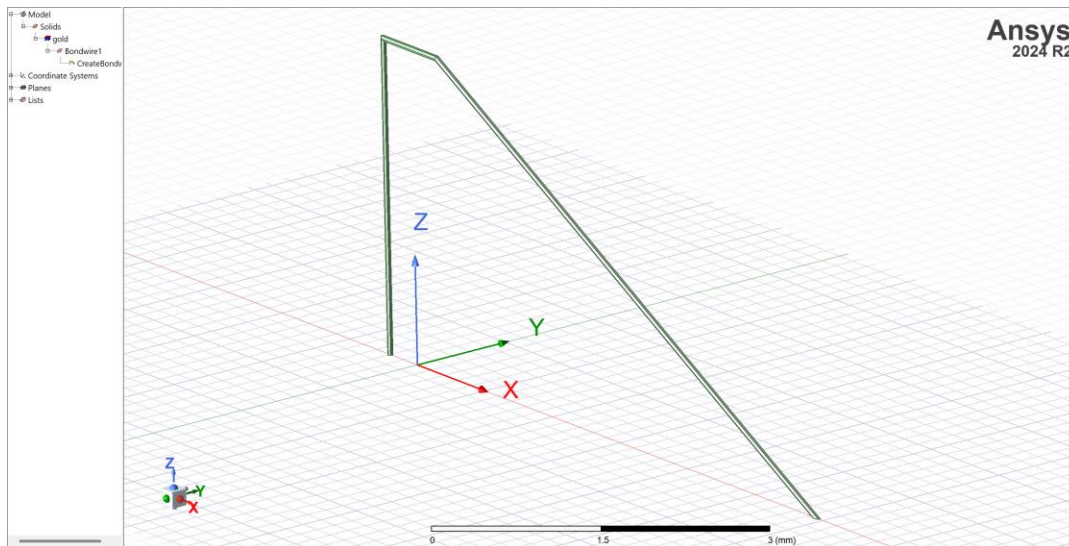
	Bondwire1:Source1
Freq: 500MHz	
Bondwire1:Source1	143.97762

- AC Resistance at 500 MHz:

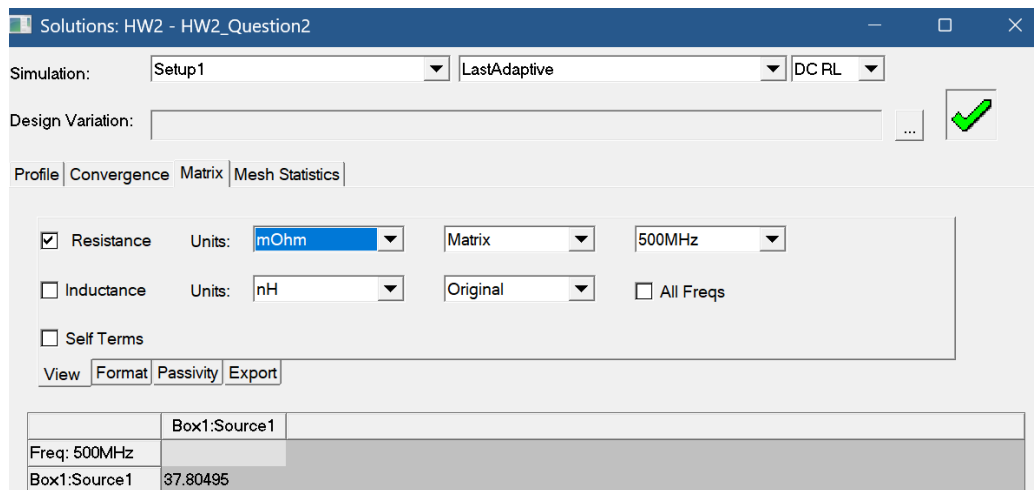
The screenshot shows the 'AC RL' simulation setup. The 'Simulation' dropdown is set to 'Setup1', 'LastAdaptive' is selected, and 'AC RL' is chosen. The 'Design Variation' field is empty. The 'Profile' tab is active, showing 'Resistance' selected with units 'mOhm', 'Matrix' selected, and '500MHz' selected. 'Inductance' is unchecked with units 'nH', 'Original' is selected, and 'All Freqs' is unchecked. 'Self Terms' is unchecked. The 'View' tab is active, showing a table with the following data:

	Bondwire1:Source1
Freq: 500MHz	
Bondwire1:Source1	460.83989

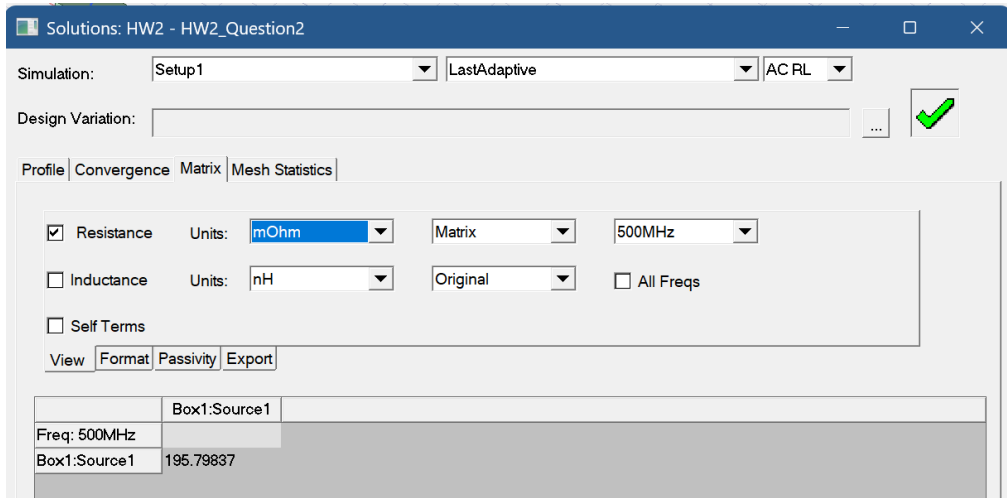
- Wire bond:



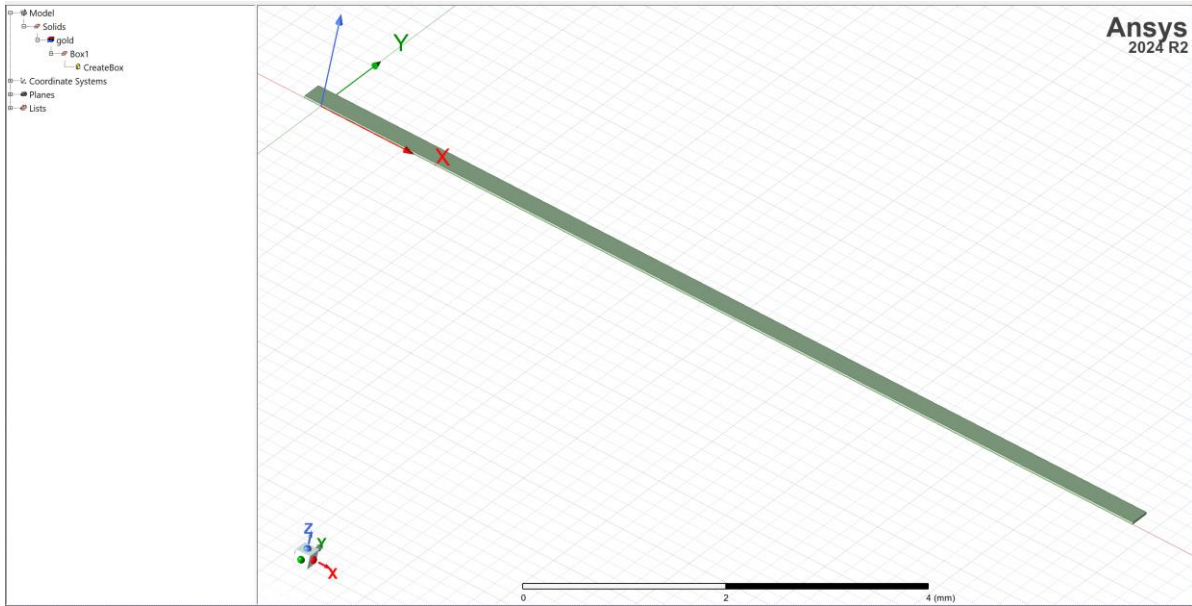
- Problem 2
 - Ribbon DC Resistance:



- Ribbon AC at 500 MHz:



- Ribbon Bond:



- Problem 1 and 2 Results:

Component and Parameter	Calculation (mΩ)	ANSYS Q3D (mΩ)	Percent Error %
Wire Bond DC Resistance	120.4	143.977	16.3755322
Wire Bond AC Resistance at 500 MHz	467.3	460.83	1.403988456
Ribbon DC Resistance	37.8	37.804	0.010580891
Ribbon AC Resistance at 500 MHz	127.4	195.798	34.93294109

- Problem 3a:
 - Length 10mm:

Solutions: HW2 - HW2_Question3

Simulation: Setup1 LastAdaptive DC RL

Design Variation: [] [] []

Profile | Convergence | Matrix | Mesh Statistics

☐ Resistance Units: ohm Matrix: 500MHz

☒ Inductance Units: nH Original ☐ All Freqs

☐ Self Terms

View Format Passivity Export

Bondwire1:Source1	
Freq: 500MHz	
Bondwire1:Source1	8.32535

Model

- Solids
 - aluminum
 - Bondwire1
 - CreateBondwire
- Coordinate Systems
- Planes
- Lists

3D model of a bondwire structure on a grid. The model is a thin, curved wire. A coordinate system is shown with X (red), Y (green), and Z (blue) axes. A scale bar at the bottom indicates 0, 2.5, and 5 mm.

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- Solutions: HW2 - HW2_Question3

Simulation:

Setup1

LastAdaptive

DC RL

Design Variation:

...

Profile

Convergence

Matrix

Mesh Statistics

☐ Resistance

Units: ohm

Matrix

500MHz

☒ Inductance

Units: nH

Original

☐ All Freqs

☐ Self Terms

View

Format

Passivity

Export

	Bondwire1:Source1
Freq: 500MHz	
Bondwire1:Source1	14.34164

Model

Solids

aluminum

Bondwire1

CreateBondwire

Coordinate Systems

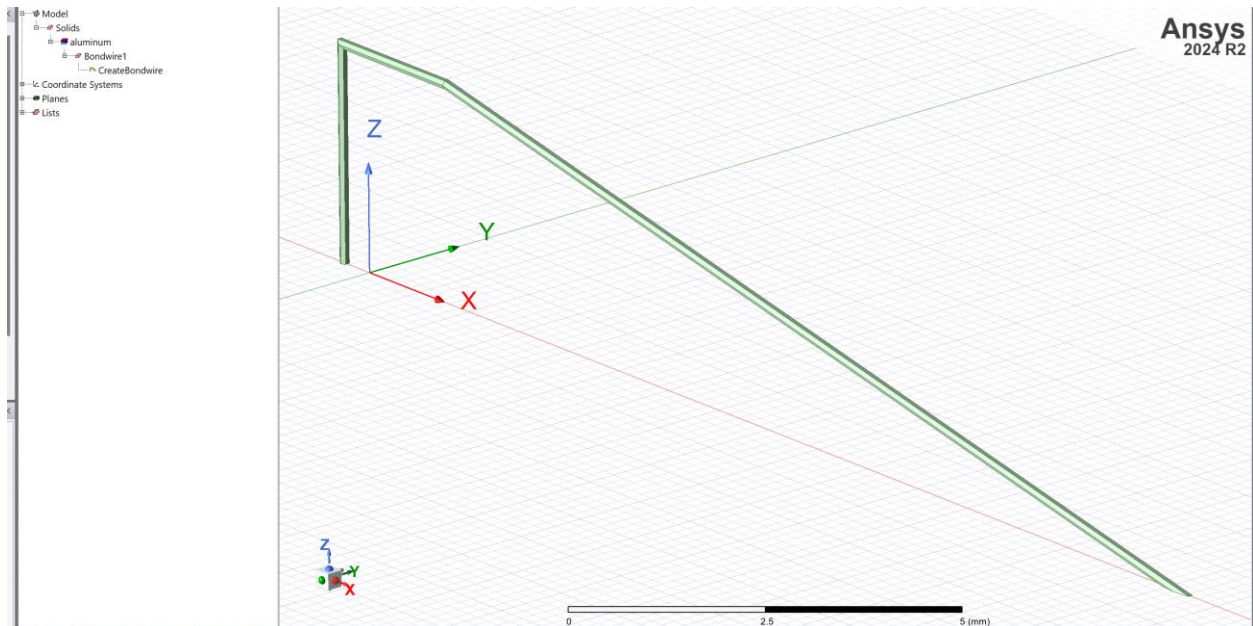
Planes

Lists

Ansys

2024 R2

- Length 20mm:



Solutions: HW2 - HW2_Question3

Simulation: Setup1 LastAdaptive DC RL

Design Variation: [] [] []

Profile | Convergence | Matrix | Mesh Statistics

☐ Resistance Units: ohm Matrix 500MHz

☒ Inductance Units: nH Original ☐ All Freqs

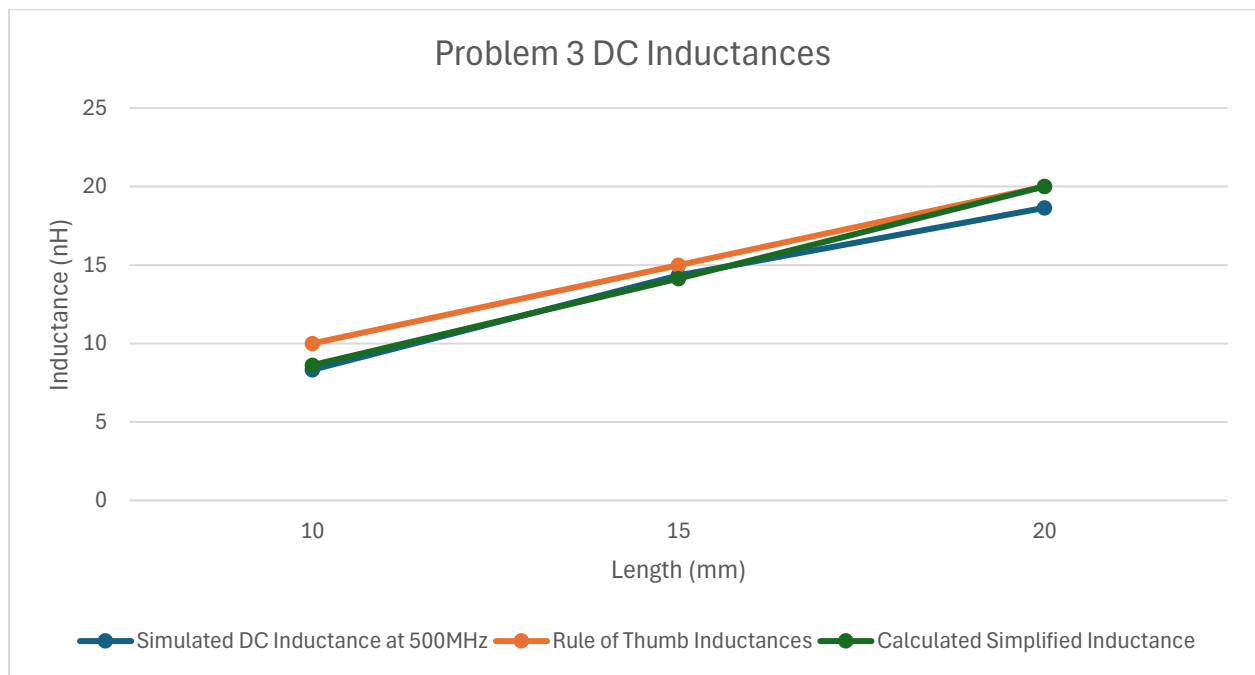
☐ Self Terms

View | Format | Passivity | Export

	Bondwire1:Source1
Freq: 500MHz	
Bondwire1:Source1	18.64569

○ Problem 3a Results and Plot:

Length (mm)	Simulated Inductance at 500 MHz (nH)
10	8.325
15	14.341
20	18.645
Length (mm)	Calculated Simplified Inductance (nH)
10	8.618600932
15	14.14429672
20	20.00979059
Length (mm)	RoT Inductance (nH)
10	10
15	15
20	20

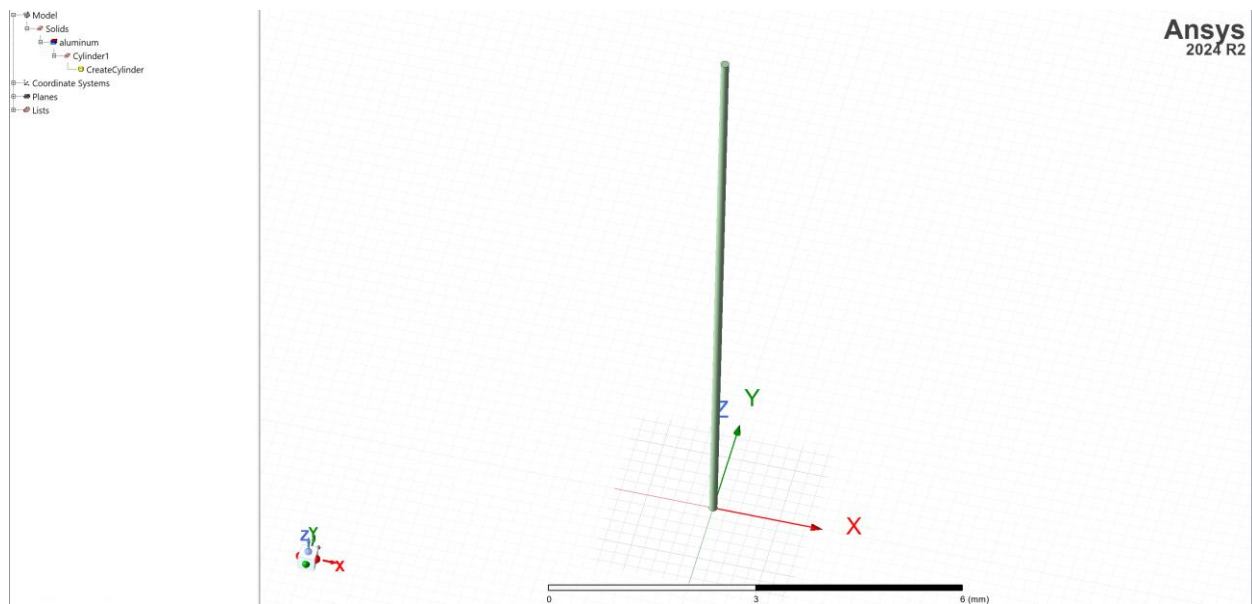


● Problem 3b:

I believe the reason why the simulated values are less in most cases and more in one case is since the simulation is taking the actual bond material and all of the extra parameters of the wire, seen below, into detail when performing the analysis.

Name	Value	Unit	Ev
Command	CreateBondwire		
Coordinate Sy...	Global		
Type	JEDEC 4-Point		
Pad position	-0.5 ,0 ,0	mm	-0.
Direction	0.9 ,0 ,0	mm	0.9
Distance	16.7	mm	16
H1	3	mm	3mm
H2	0	mm	0mm
Diameter	5	mil	5mm
Number of Fa...	6		6
Axis	Z		
Reverse Direc...	<input type="checkbox"/>		

The simulation is also being run at a 500 MHz frequency and is probably considering the skin and proximity effects of the wire bond. When using the RoT, it's not considering anything b/c the wire bond is the "ideal" wire in this case. Below you can see the results for an "ideal" bond with no bends and how the length is basically the same as the inductance.



Solutions: HW2 - HW2_Question3b

Simulation:

Setup1

LastAdaptive

DC RL

Design Variation:

...

Profile

Convergence

Matrix

Mesh Statistics

☐ Resistance

Units: ohm

Matrix

500MHz

☒ Inductance

Units: nH

Original

☐ All Freqs

☐ Self Terms

View

Format

Passivity

Export

	Cylinder1:Source1
Freq: 500MHz	
Cylinder1:Source1	10.03914