HOMOPOLAR "generator like" operation ?

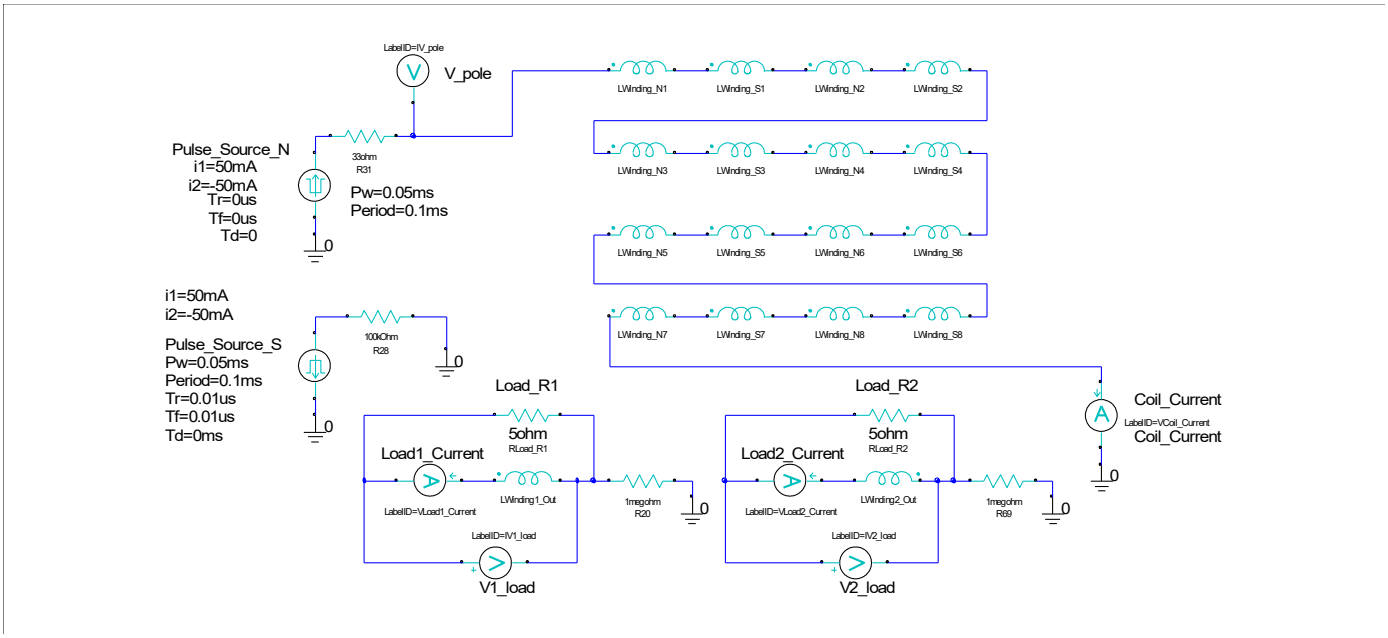
TFG_Z05 PRELIMINARY PERFORMANCE STUDY

NOTE: These figures are Rough Order of Magnitude (ROM) estimates only. They are solely for the purpose of design engineering analysis and are subject to errors, omissions, and change.

Output swings "+" & "-" since the fields in the "U" Core reverse via the NS sequencing, Homopolar generators provide a DC output since they "spin" only in one direction? Interesting operation non-the-less.

[Driver current is kept constant at a (+50mA/-50mA) 100mA Square Wave - simulates a Full H-Bridge]

Loop turns does NOT seem to have an effect on the output power - which leads me to believe the system is behaving like a Homopolar device. This will likely be affected by the Output Load characteristics.



Very Preliminary Observations: *(based on the WAG dimensions and physical layout)*

- Number of Loop turns does not seem to make a significant difference (Output Loop terminated into 5 ohms),

- Frequency (Pulse - Pperiod and Pwidth) does not seem to increase the output to any extent,

- Coil turns DOES have a significant impact on the output. Appears to be the 'prime parameter.'

- Output ranges from **24.2KW** (500 Coil turns) to **49.3W** (20 Coil turns) at a Coil Drive of 100mA (+50mA/-50mA).

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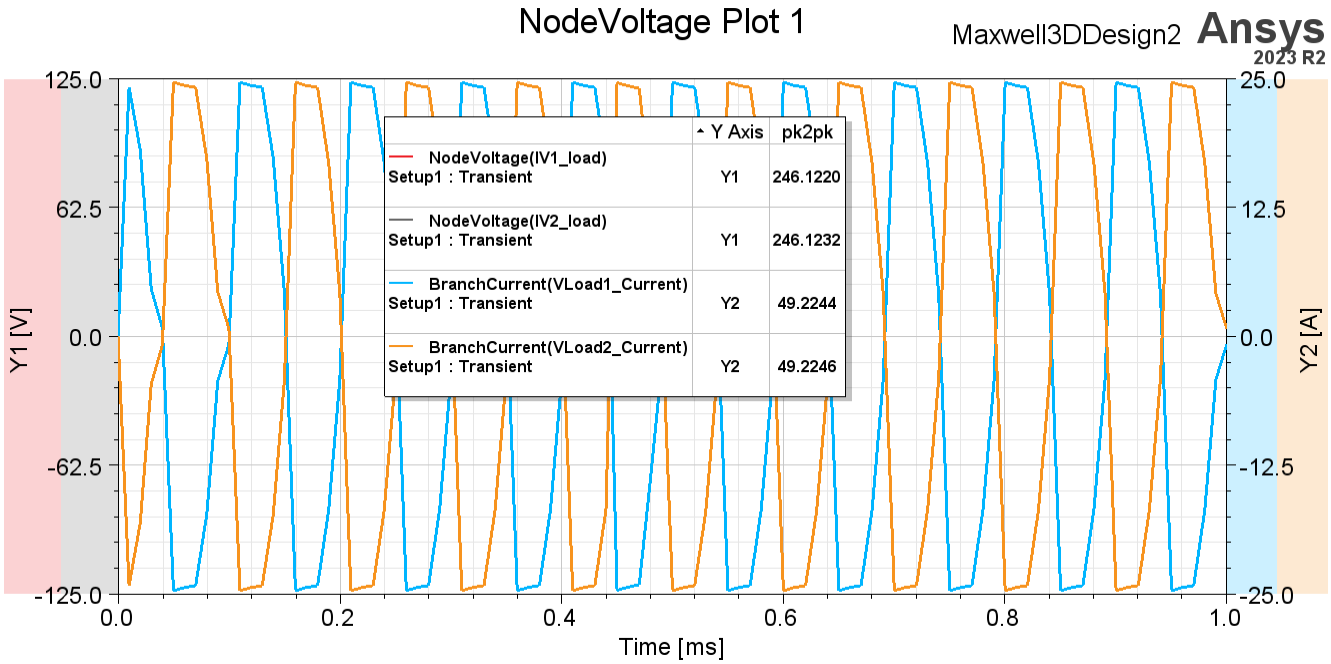
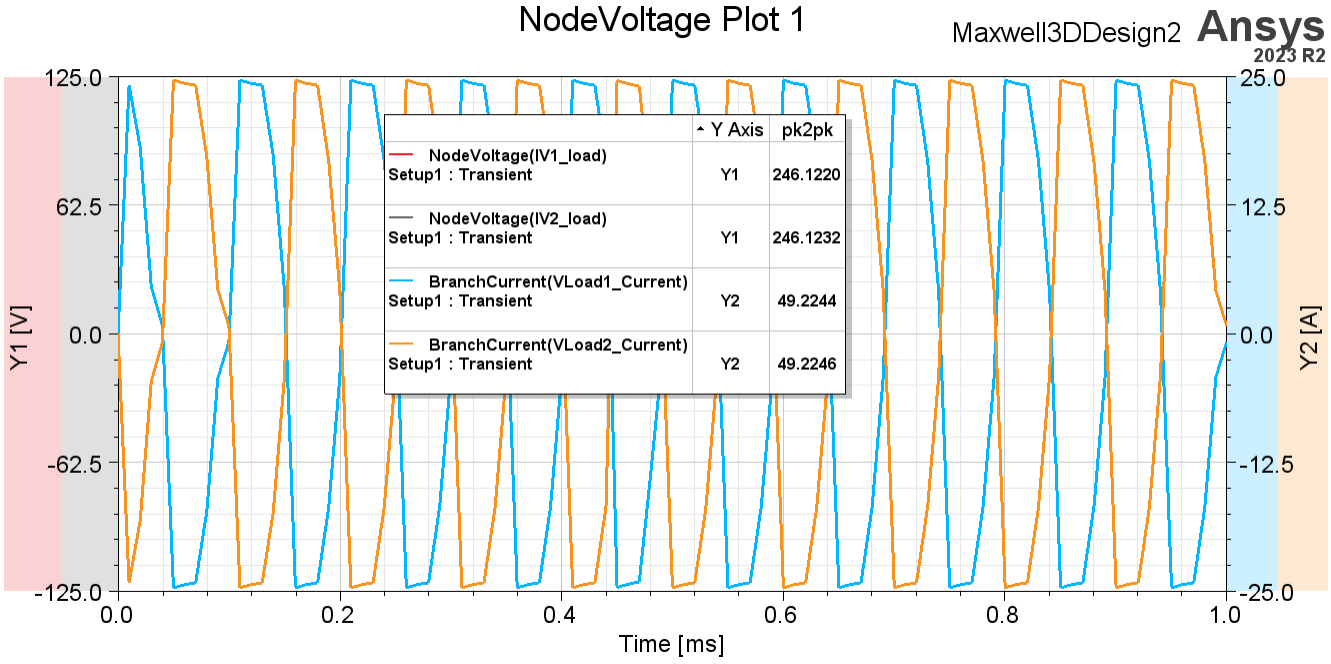
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **500** Coil turns, **1000** Loop turns:

{ 246Vpp X 49.2App = 12,108 W X 2 Loops = 24.2 KW }



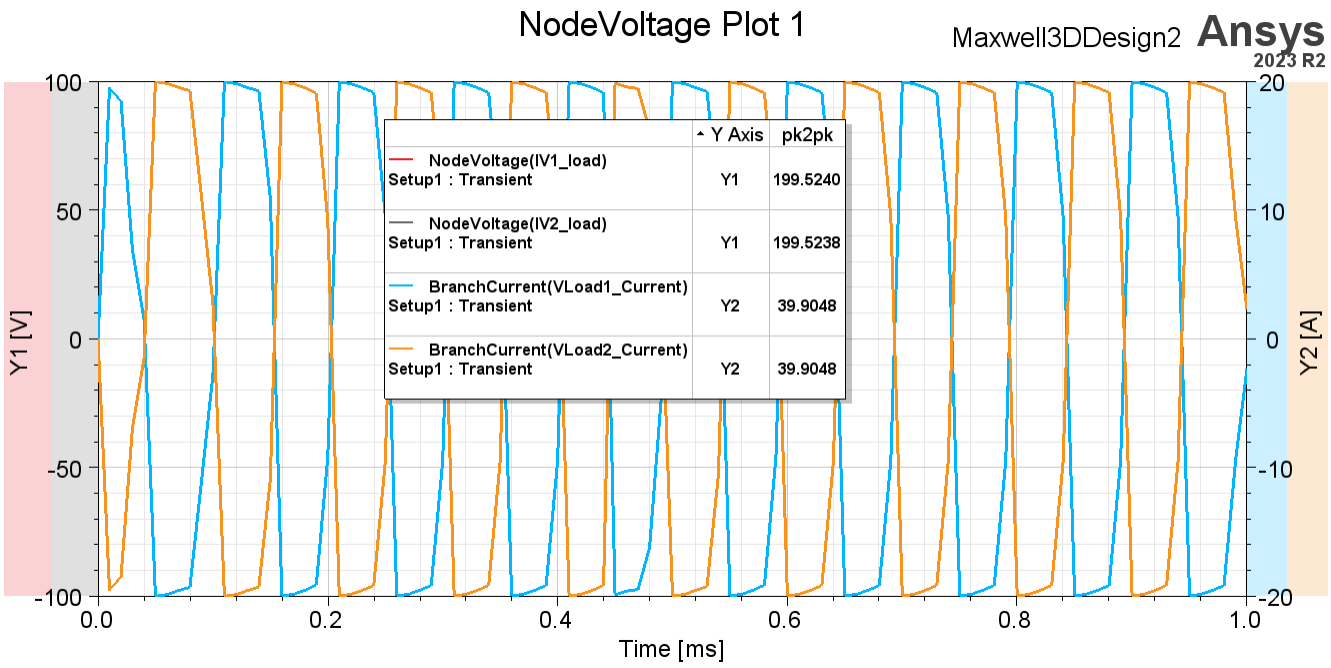
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **500** Coil turns, **1** Loop turn:

{ 246Vpp X 49.2App = 12,108 W X 2 Loops = 24.2 KW }



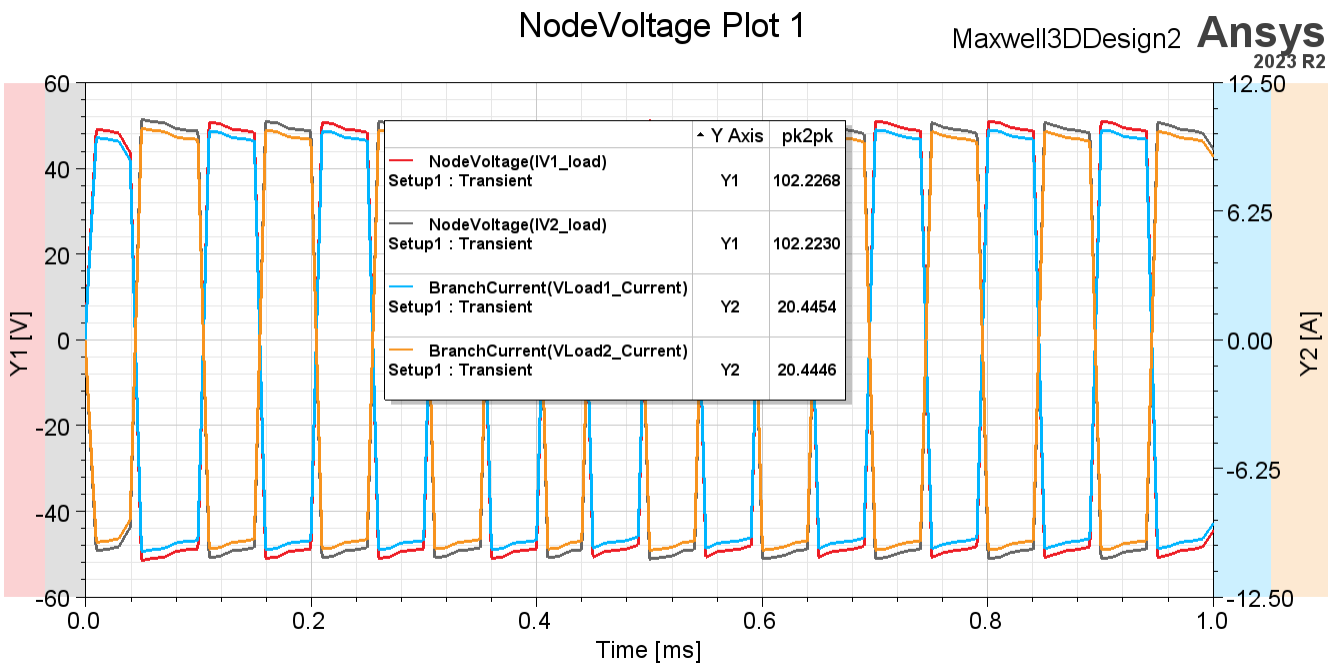
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **400** Coil turns, **1** Loop turn:

{ 200Vpp X 40App = 8,000 W X 2 Loops = 16 KW }



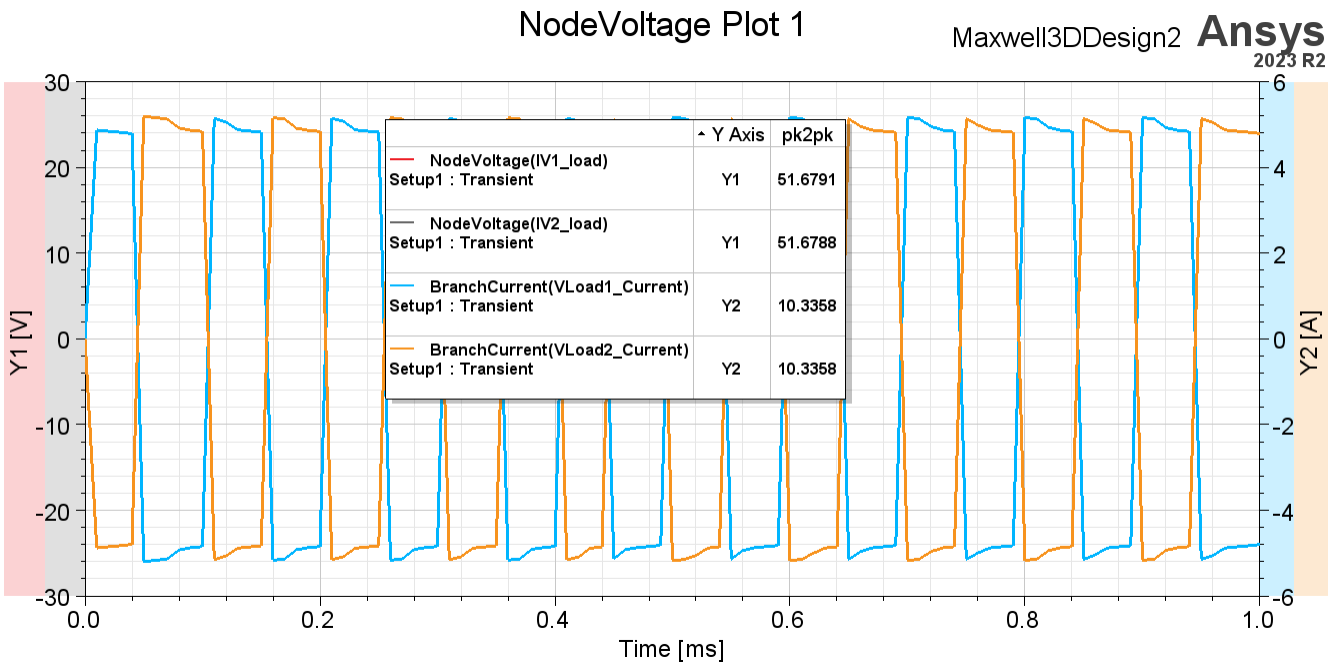
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **200** Coil turns, **1** Loop turn:

{ 102.2Vpp X 20.44App = 2,089 W X 2 Loops = 4.177 KW }



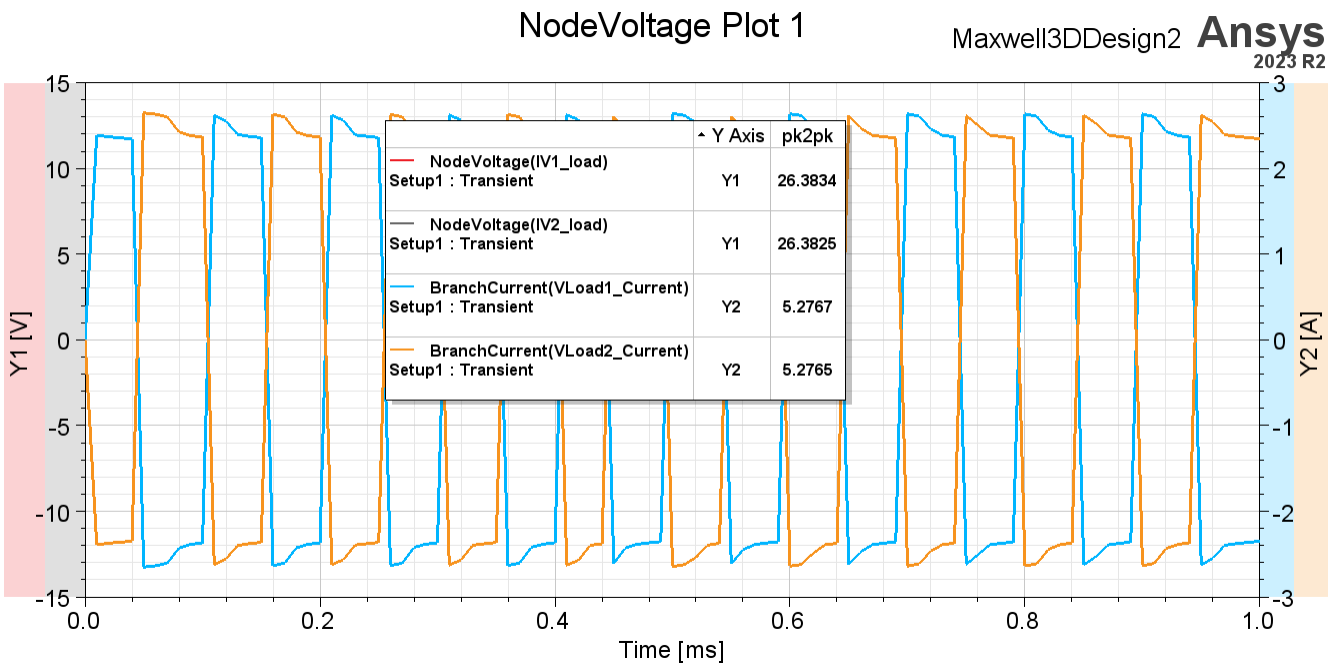
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **100** Coil turns, **1** Loop turn:

{ 51.7Vpp X 10.3App = 532.5 W X 2 Loops = 1.065 KW }



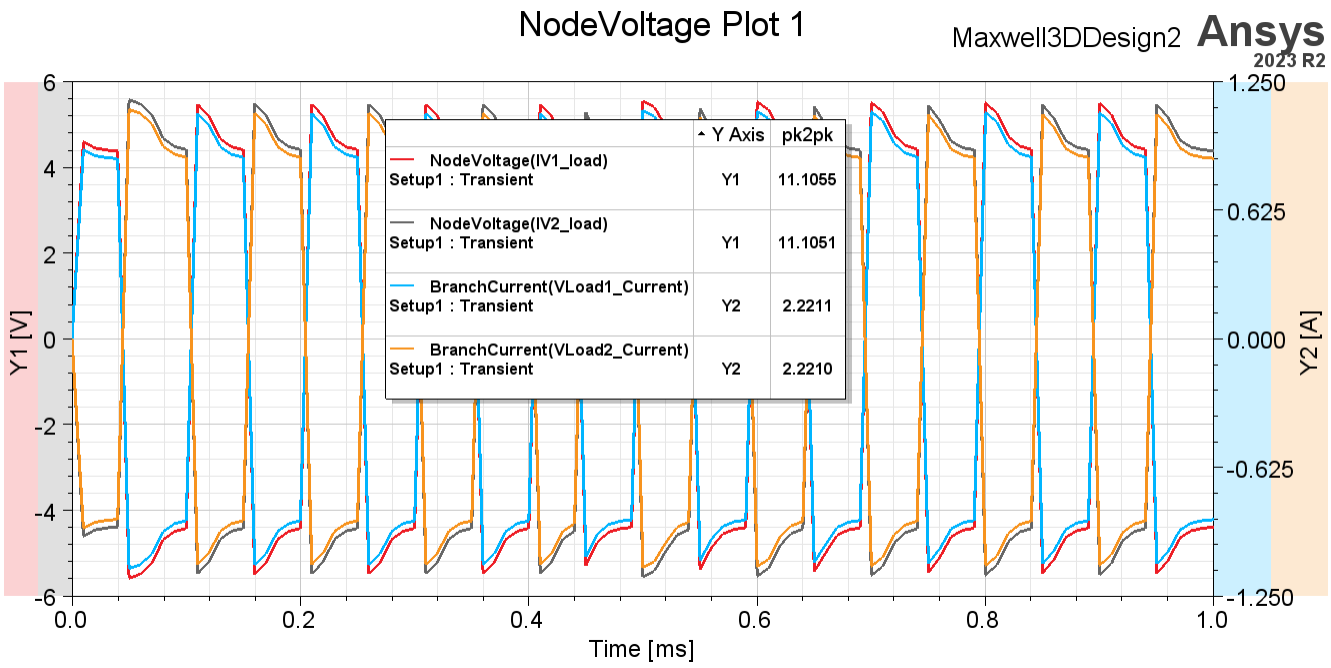
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **50** Coil turns, **1** Loop turn:

{ 26.4Vpp X 5.3App = 140 W X 2 Loops = 280 W }



Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns, **1** Loop turn:

{ 11.1Vpp X 2.22App = 24.6 W X 2 Loops = 49.3 W }



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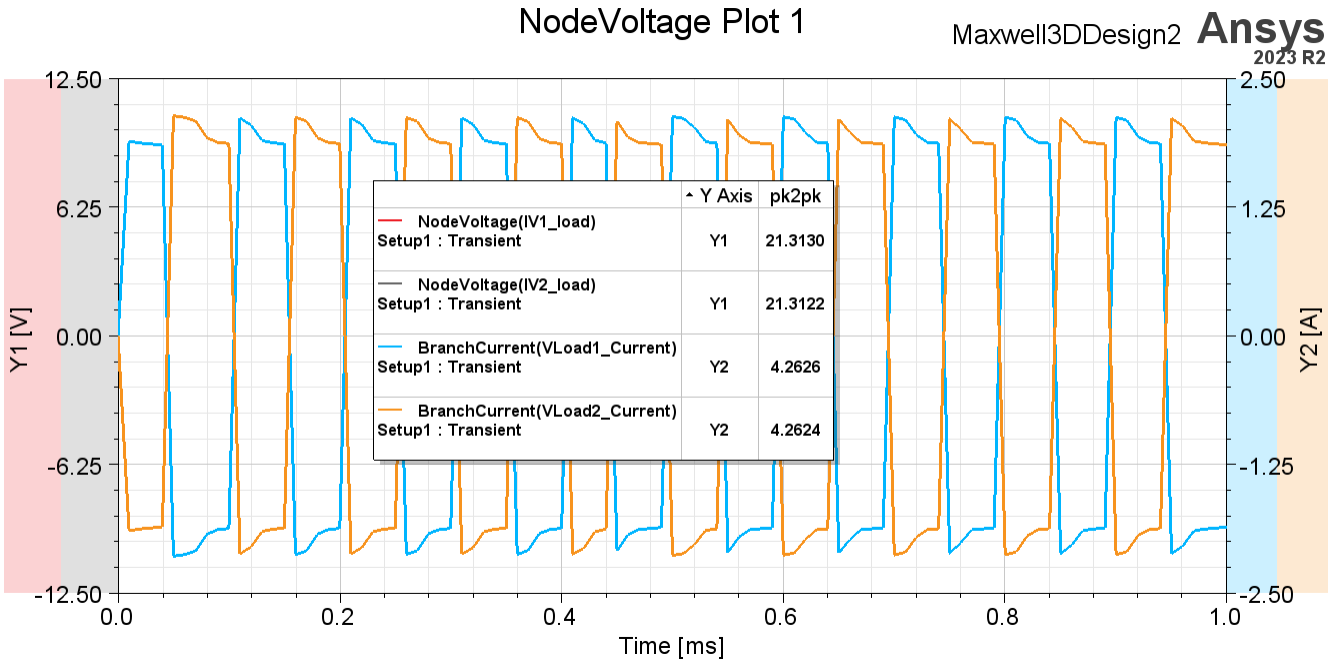
As a validation - **change the current in the circuit to +100mA/-100ma (200mA)**, everything else remains the same
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns, **1** Loop turn:

{ 21.3Vpp X 4.26App = 90.7 W X 2 Loops = 181.5 W }



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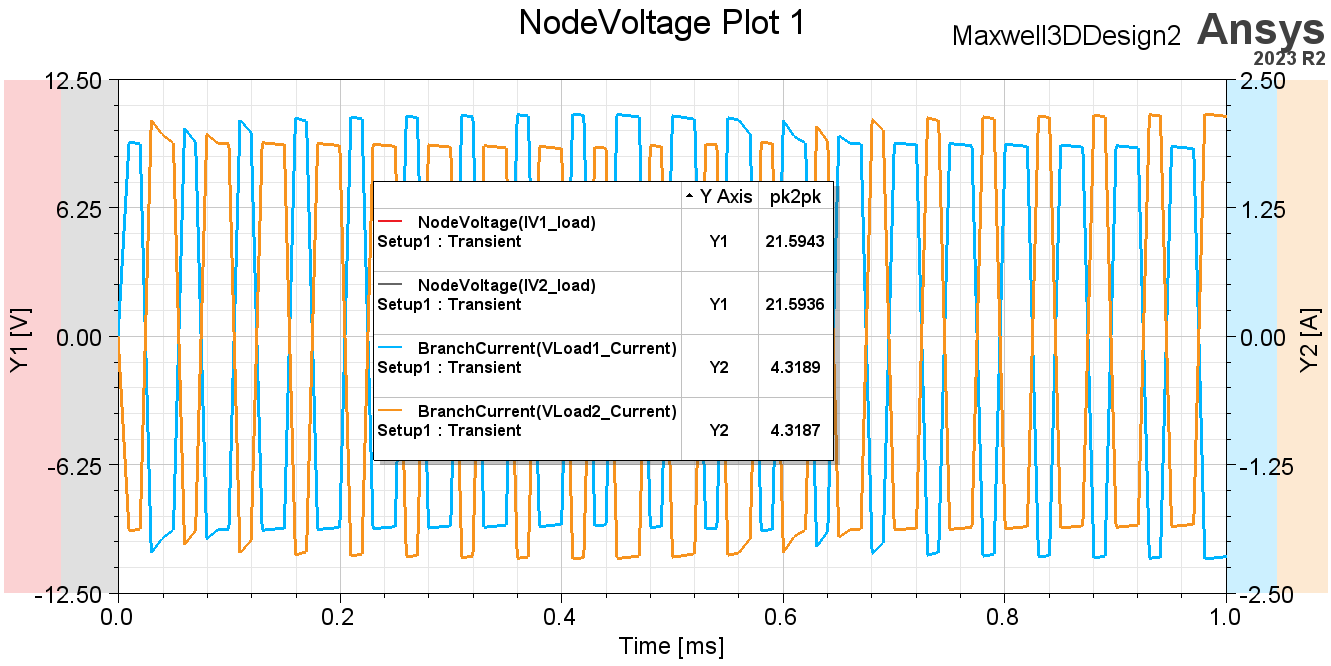
Change the Frequency from 10Hz to **20Hz** (Pwidth=0.025mS, Pperiod=0.05mS) Leave the rest the same.

{ 21.6Vpp X 4.3App = 92.9 W X 2 Loops = 185.76 W }



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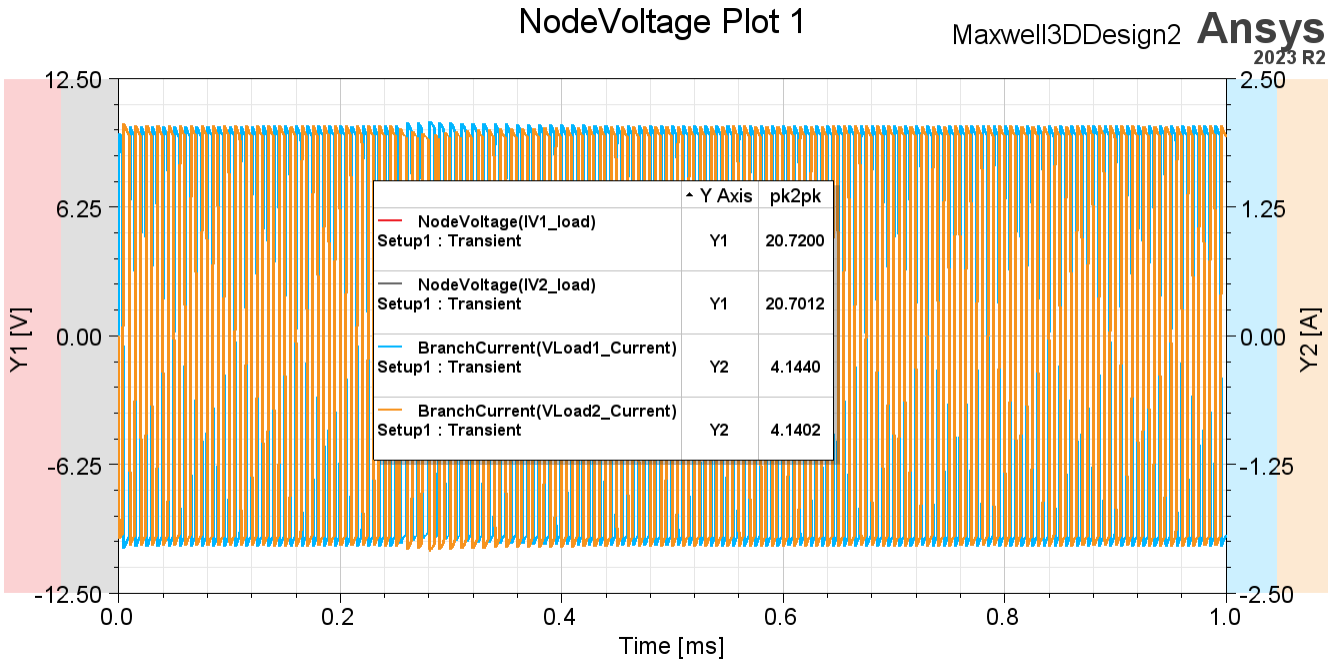
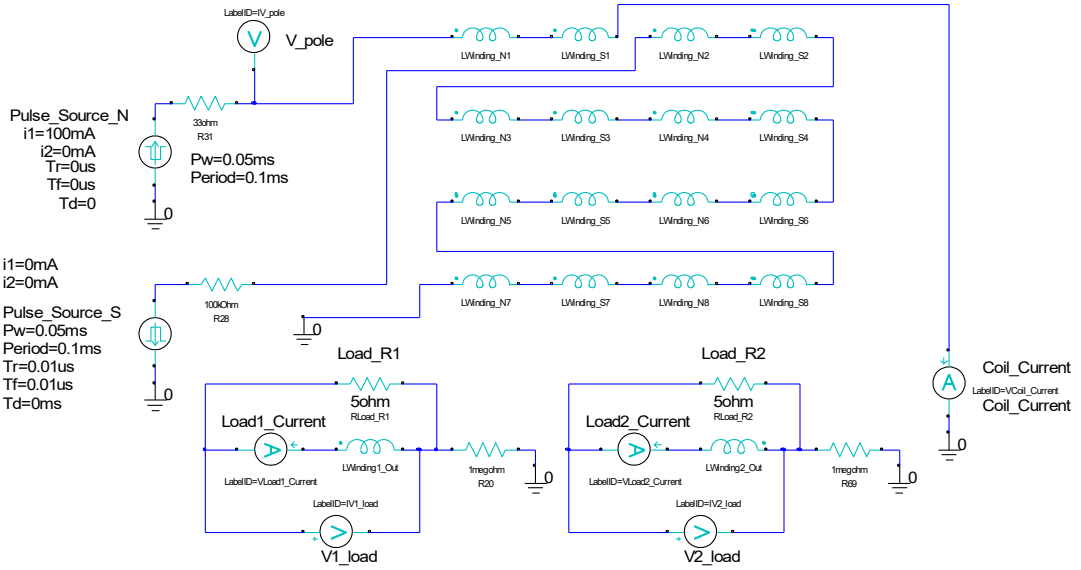
Frequency 100Hz [Pwidth=0.005mS ,Pperiod=0.01mS],
Coil turns = 20, Loop turns = 50; **Drive = +100mA/-100mA (200mA)**

{ 20.7Vpp X 4.14App = 85.7 W X 2 Loops = 171.4 W }



========== ADD EACH POLE IN SEQUENCE ==========

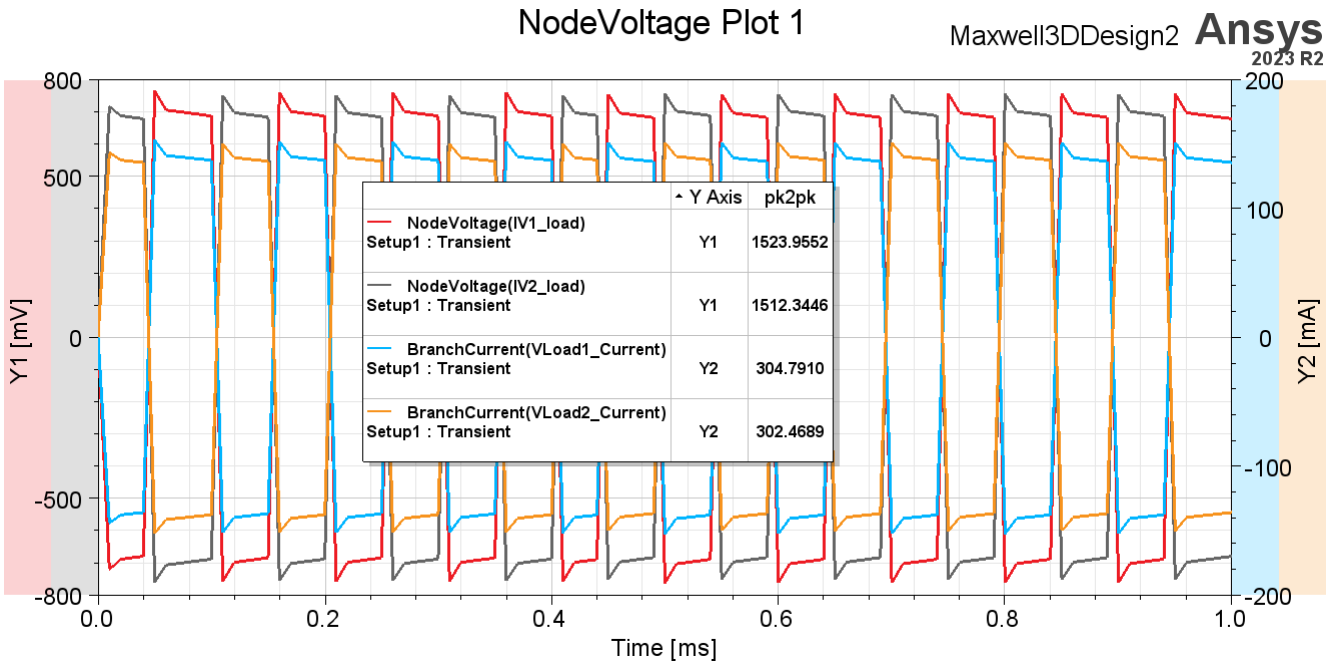


---------- *From the Schematic - LWinding _N1 => N1, LWinding_S1 => S1* ----------

1 of 8 POLES:

Active: N1/S1 - Short: N2/S2 N3/S3 N4/S4 N5/S5 N6/S6 N7/S7 N8/S8
PW = 0.05 Pp = 0.1; **Coil turns = 100, Loop = 1**; Drive = -50mA/+50mA (100mA)

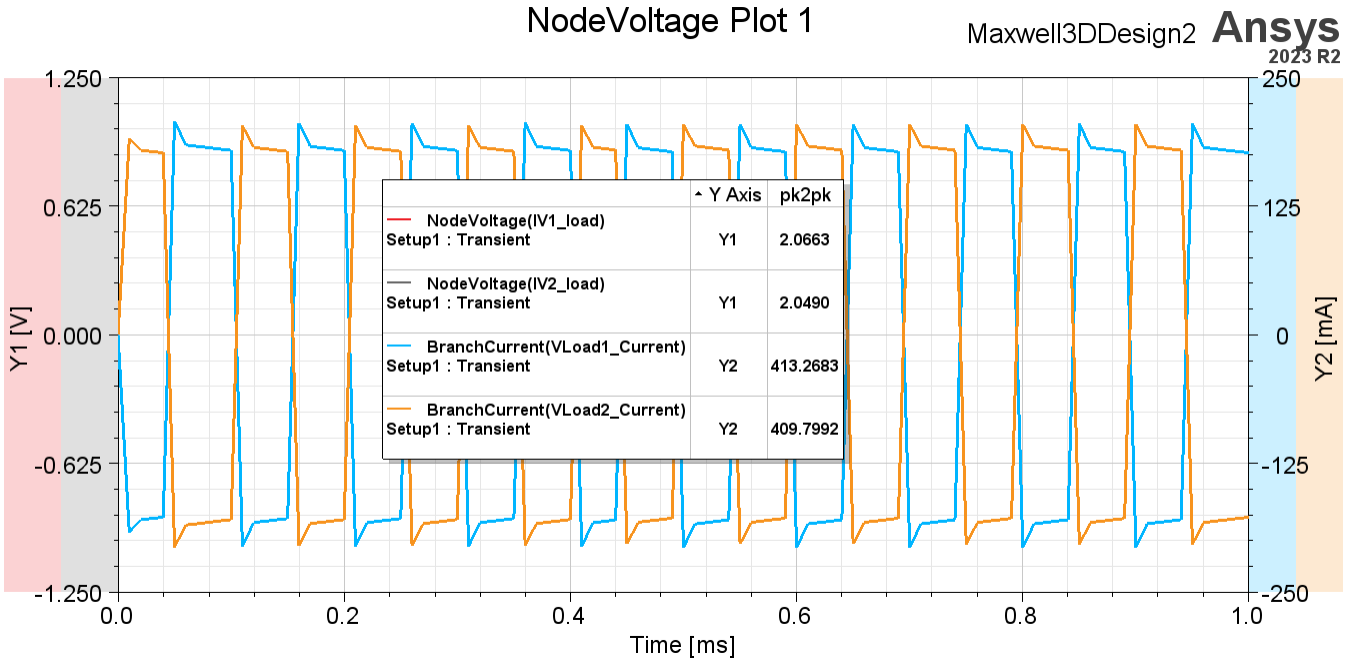
{ 1.523Vpp X 0.303App = 0.461 W X 2 Loops = 0.923 W }



2 of 8 POLES:

Active: N1/S1 N2/S2 - Short: N3/S3 N4/S4 N5/S5 N6/S6 N7/S7 N8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 2.07Vpp X 0.412App = 0.852 W X 2 Loops = 1.07 W }



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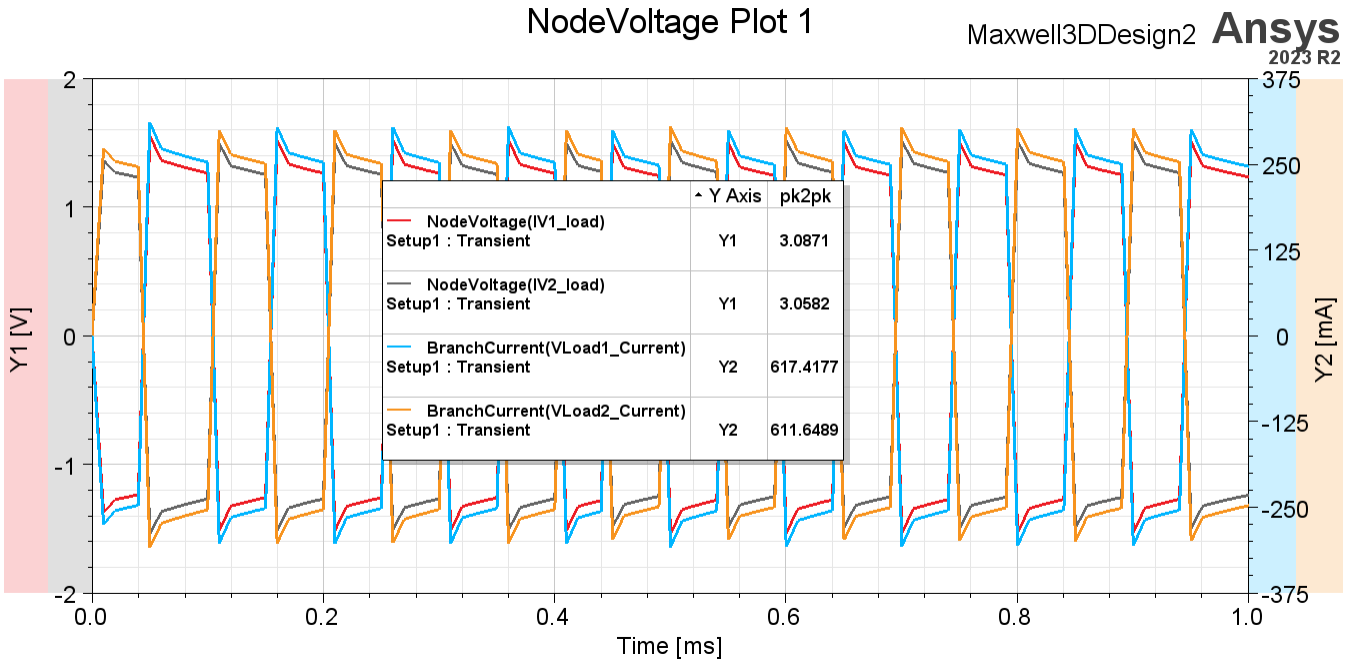
3 of 8 POLES:

Active: N1/S1 N2/S2 N3/S3 - Short: N4/S4 N5/S5 N6/S6 N7/S7 N8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 3.09Vpp X 0.615App = 1.90 W X 2 Loops = 3.80 W }



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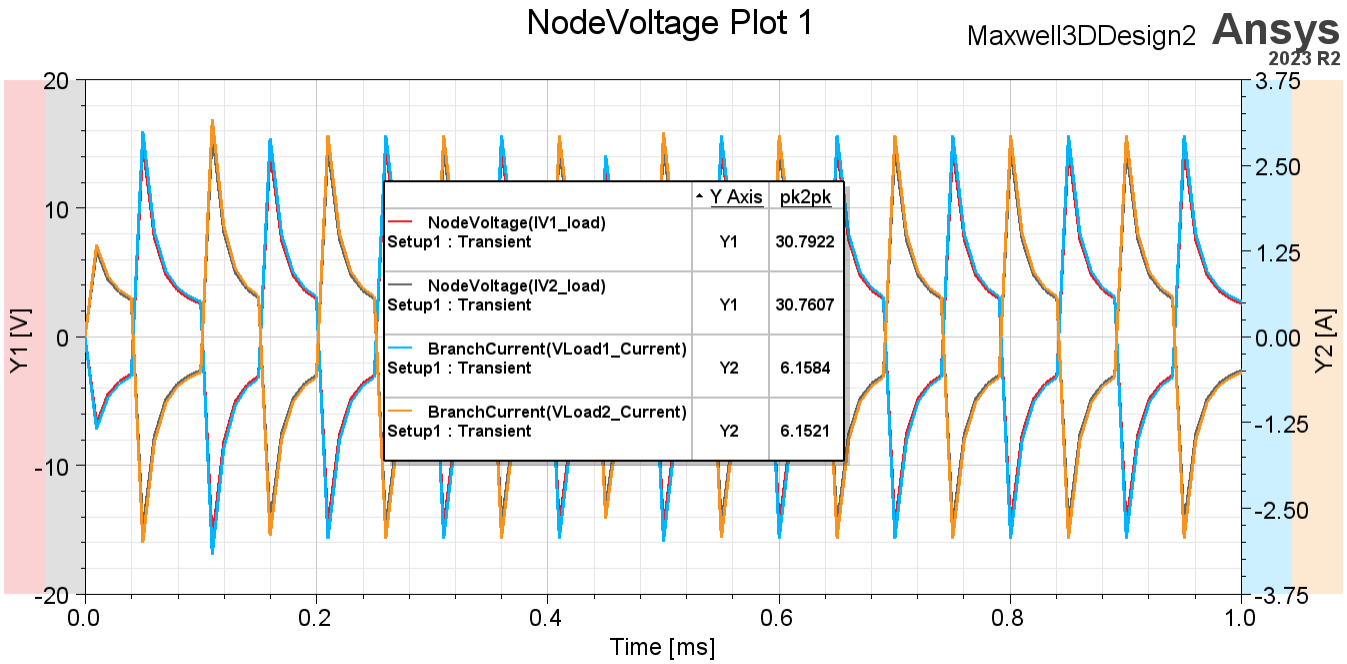
4 of 8 POLES:

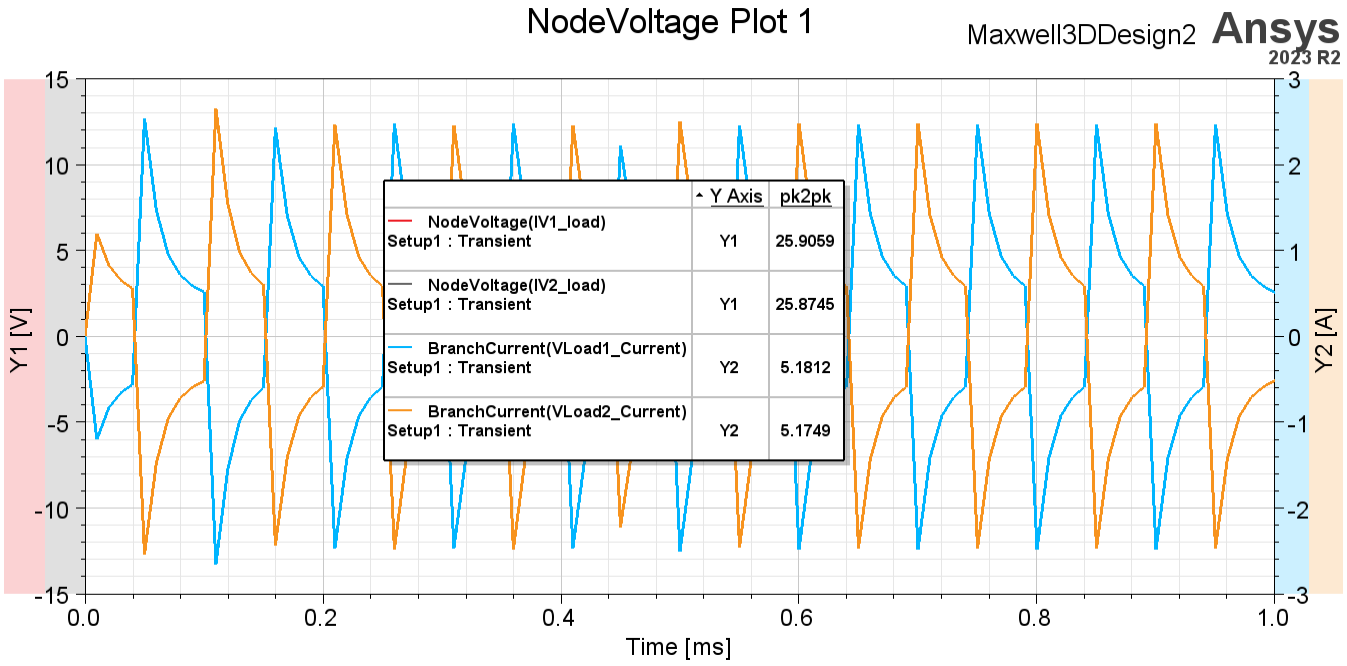
Active: N1/S1 N2/S2 N3/S3 N4/S4 - Short: N5/S5 N6/S6 N7/S7 N8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 3.09Vpp X 0.615App = 1.90 W X 2 Loops = 3.80 W }



REQUITES A CLOSER LOOK - Cause unknown at the moment!

Drop back to Coil turns = 80:



REQUITES A CLOSER LOOK - Cause unknown at the moment!

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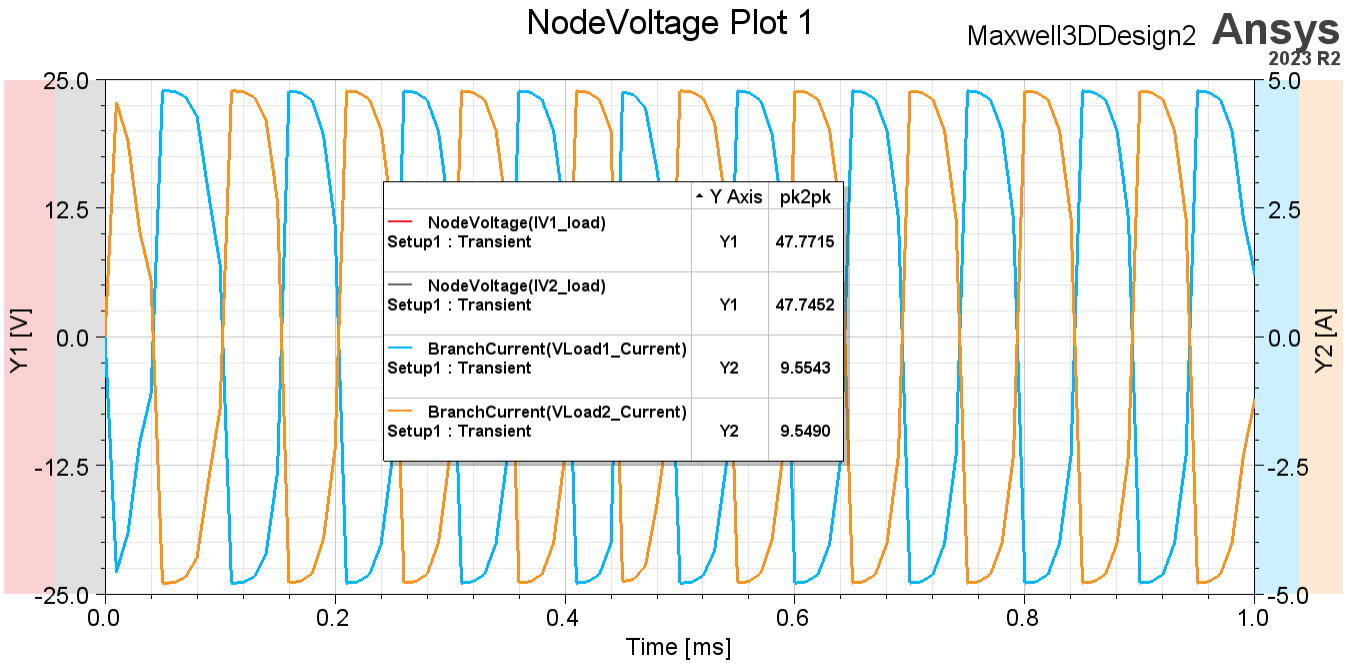
5 of 8 POLES:

Active: N1/S1 N2/S2 N3/S3 N4/S4 N5/S5 - Short: N6/S6 N7/S7 N8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 47.8Vpp X 9.55App = 456.5 W X 2 Loops = 913 W }



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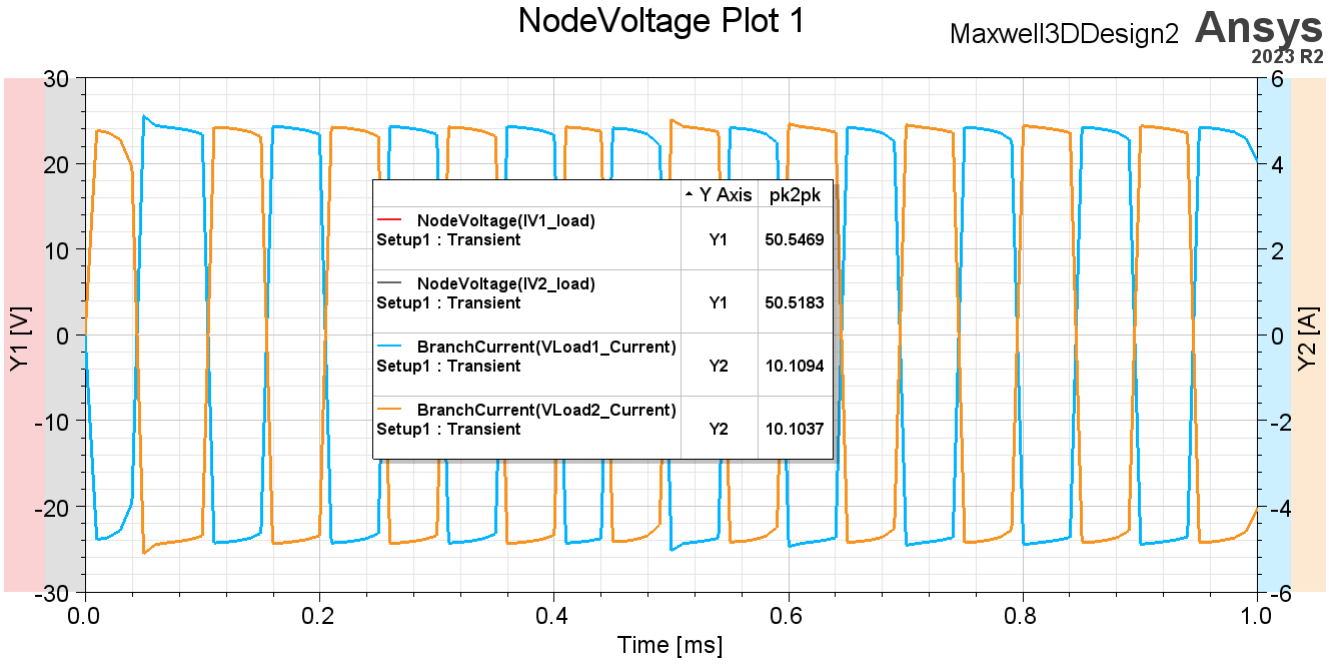
6 of 8 POLES:

Active: N1/S1 N2/S2 N3/S3 N4/S4 : N5/S5 N6/S6 - ShortN7/S7 N8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 50.52Vpp X 10.1App = 510 W X 2 Loops = 1.021 KW }



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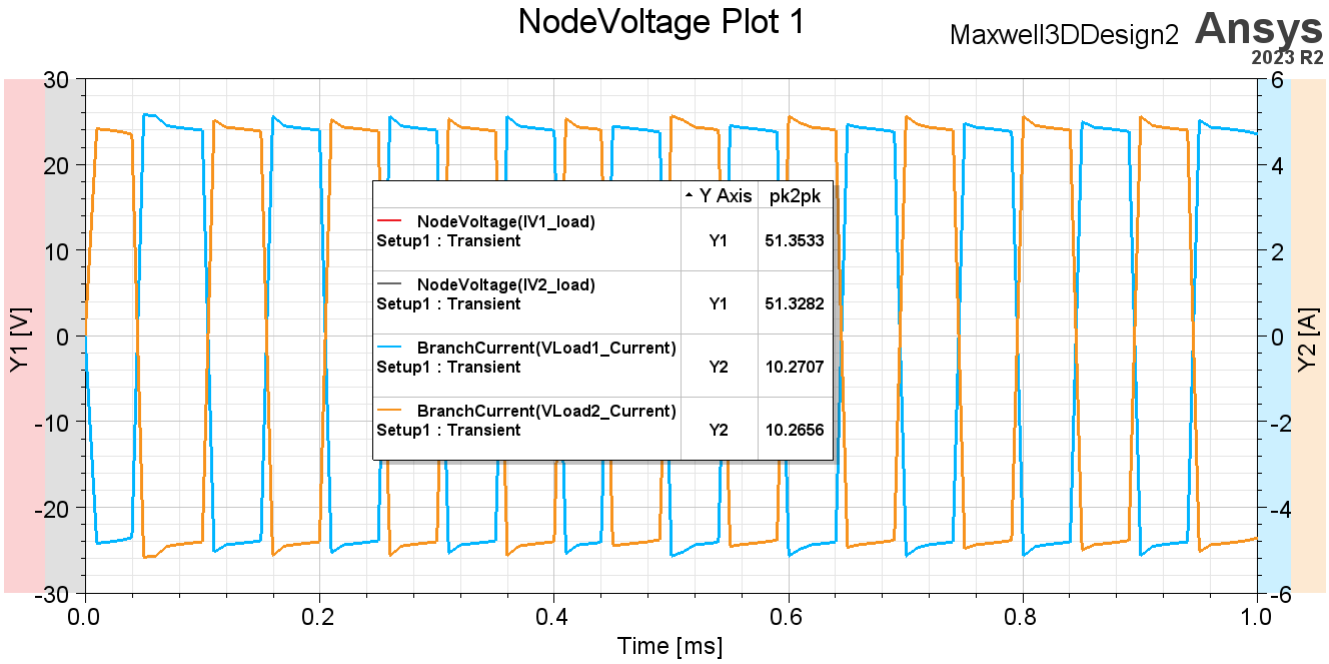
7 of 8 POLES:

Active: N1/S1 N2/S2 N3/S3 N4/S4 : N5/S5 N6/S6 N7/S7 - ShortN8/S8
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 51.32Vpp X 10.27App = 527 W X 2 Loops = 1.054 KW }



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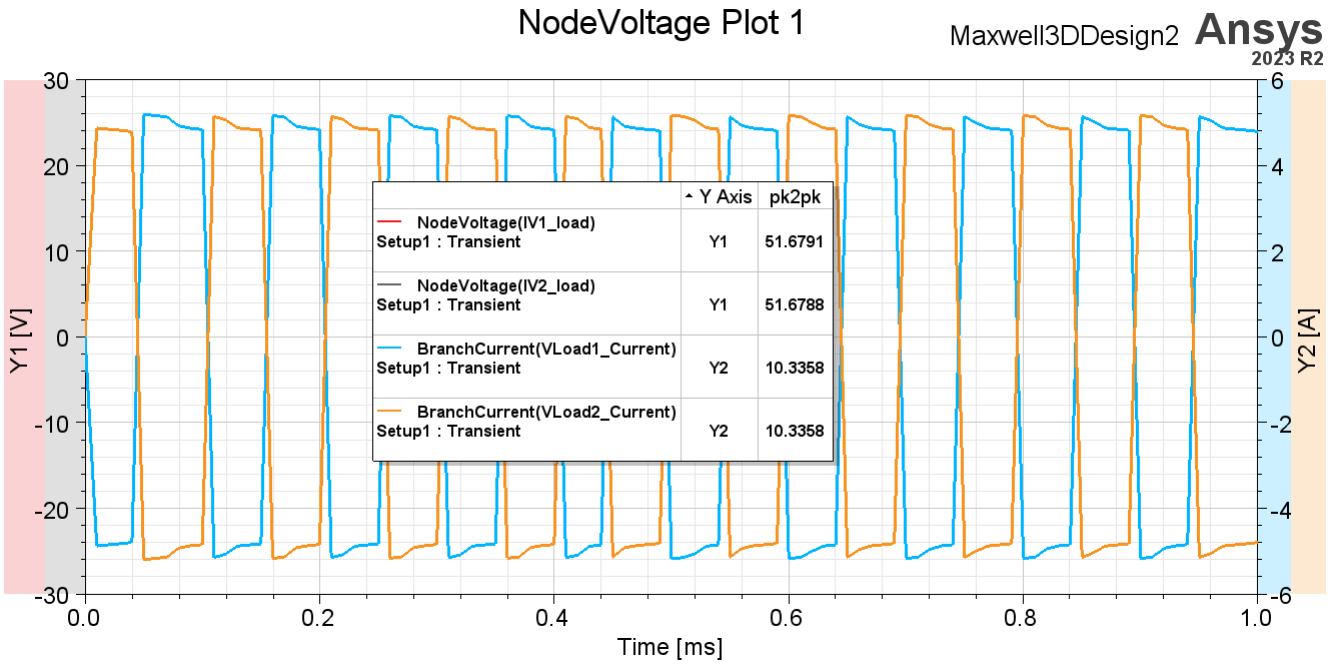
8 of 8 POLES:

Active: N1/S1 N2/S2 N3/S3 N4/S4 N5/S5 N6/S6 N7/S7 N8/S8- Short: 0
PW = 0.05 Pp = 0.1; Coil turns = 100, Loop = 1; ; Drive = -50mA/+50mA (100mA)

{ 51.6Vpp X 10.34App = 533.5 W X 2 Loops = 1,067 KW }



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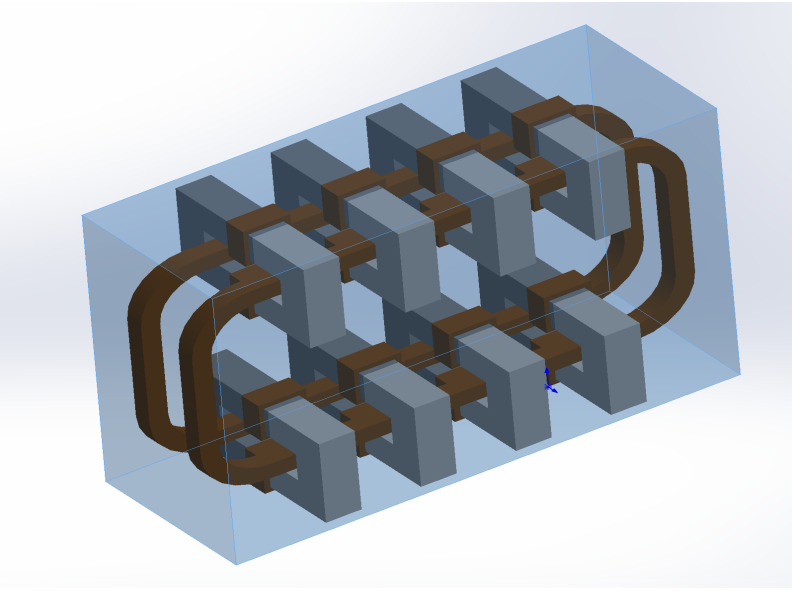
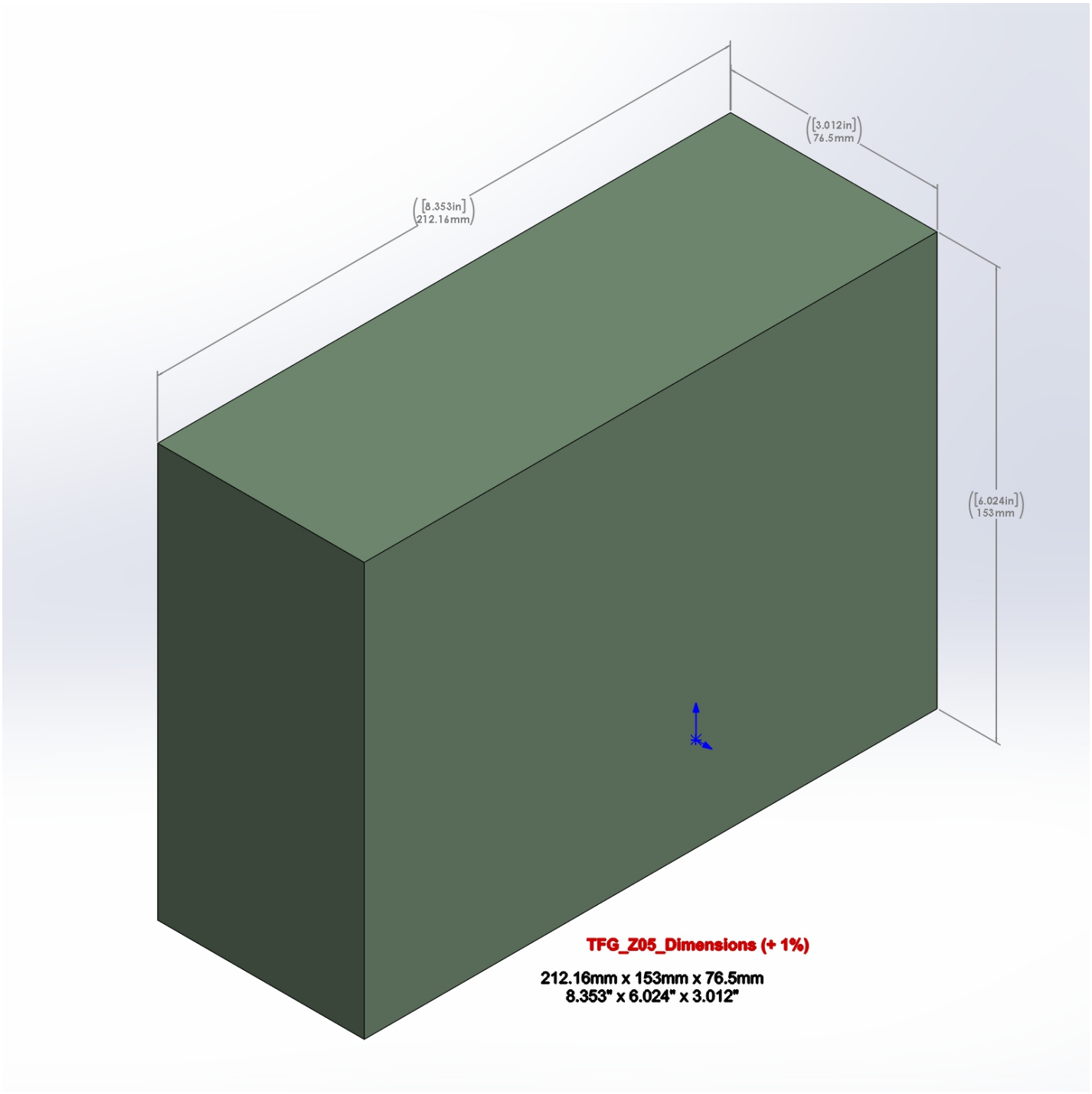
Adding Poles seems to appear straight forward, except an anomoly was seen at "4 of 8 Poles." This observation will require further investigation.

SUMMARY

A TFG_EE (Transverse Flux Generator using Electronically controlled Electromagnets) similar to the discussed WAG approach appears to meet, or exceed, all design requirements based upon preliminary CAE Analysis.





SL (solarlab) 31 December 2023