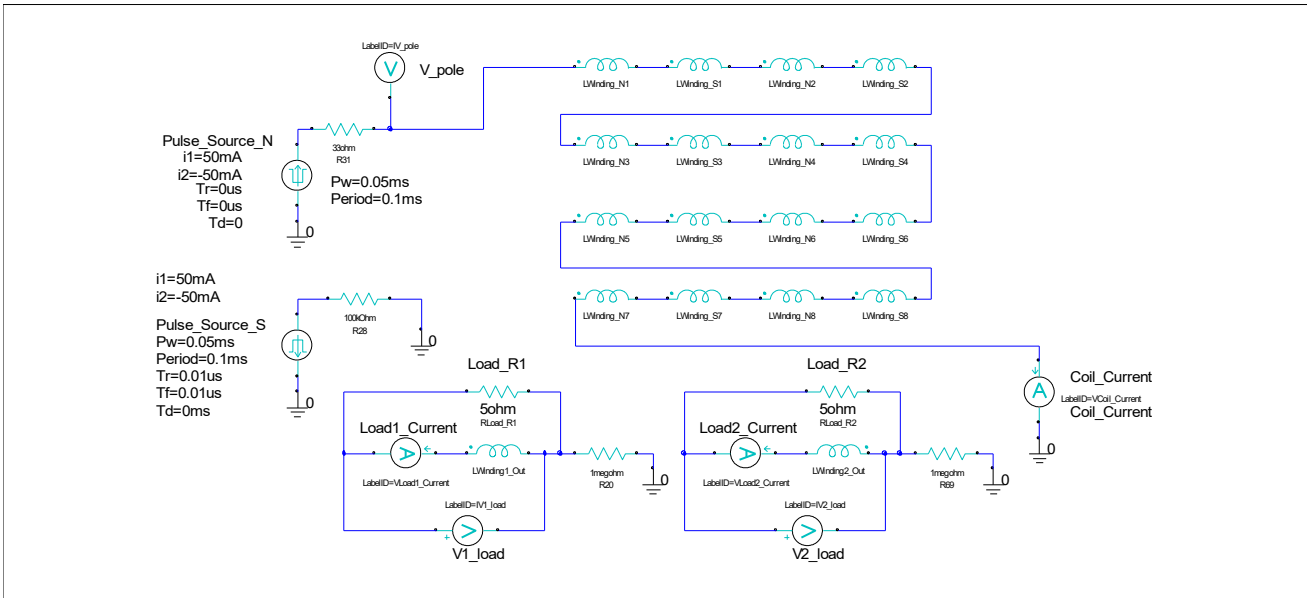
TFG_Z05 - Worksheets - PRELIMINARY PERFORMANCE STUDY

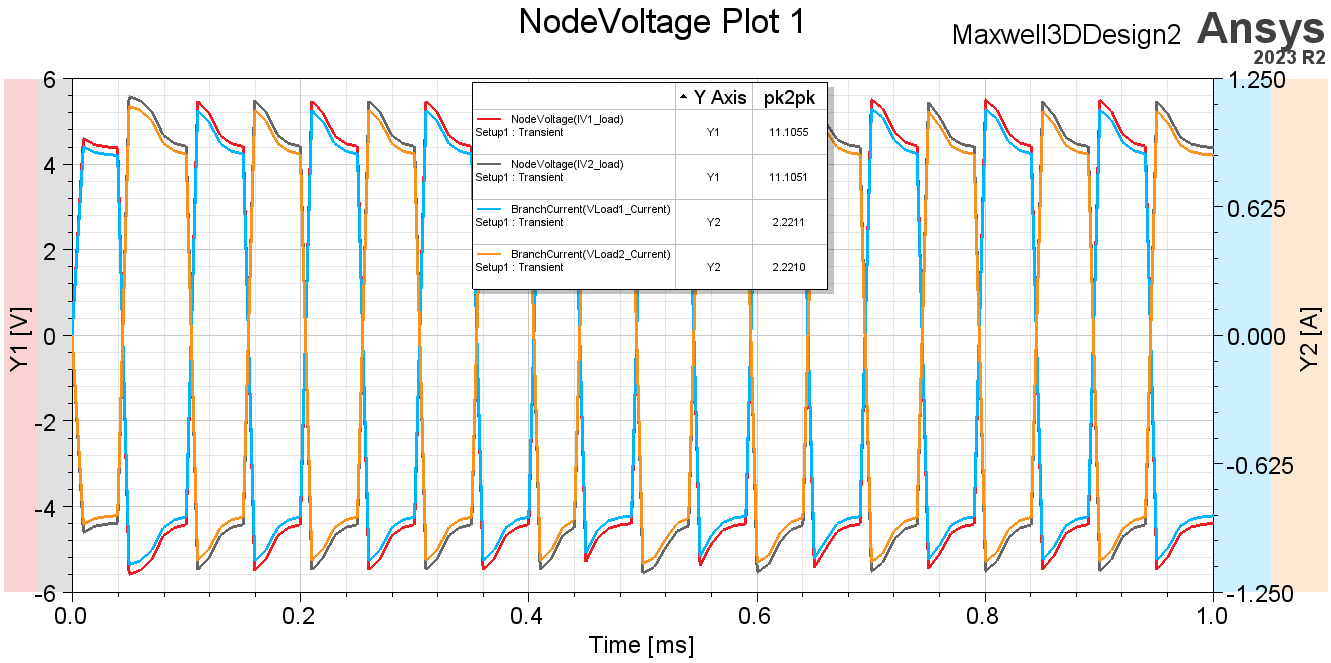
[Trise = Tfall = 0mS] {reset to 0 time step for each run}

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

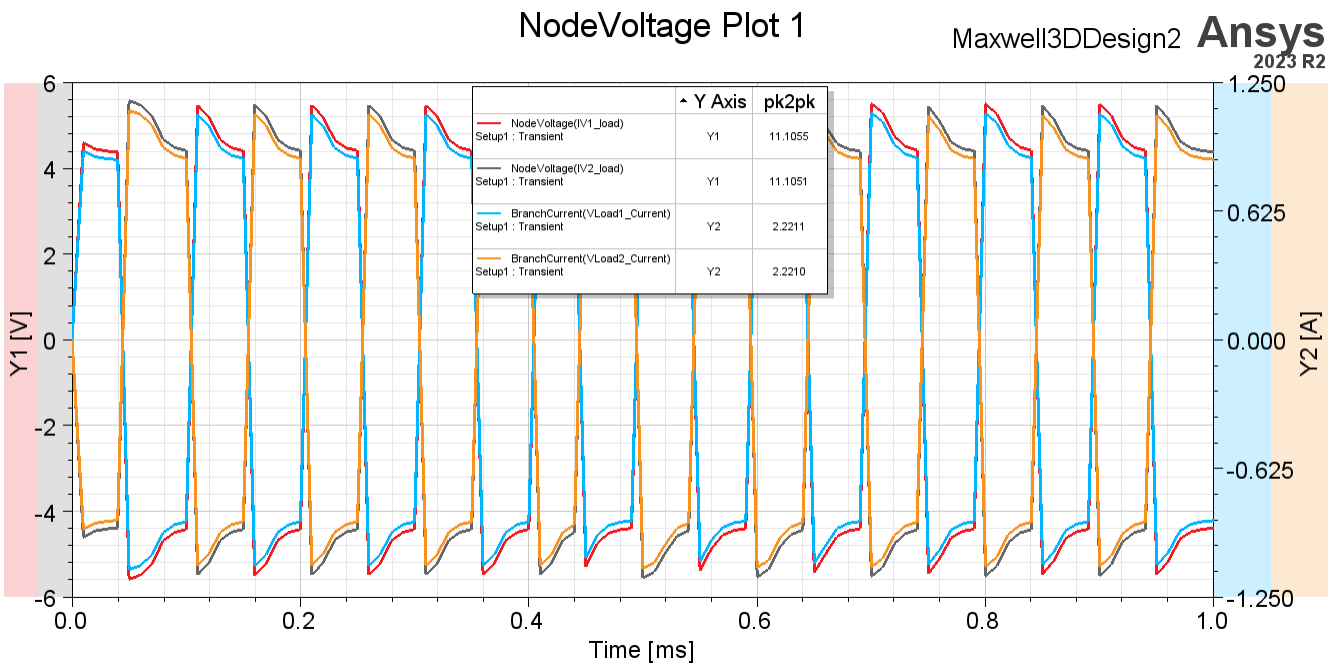
Schematic:



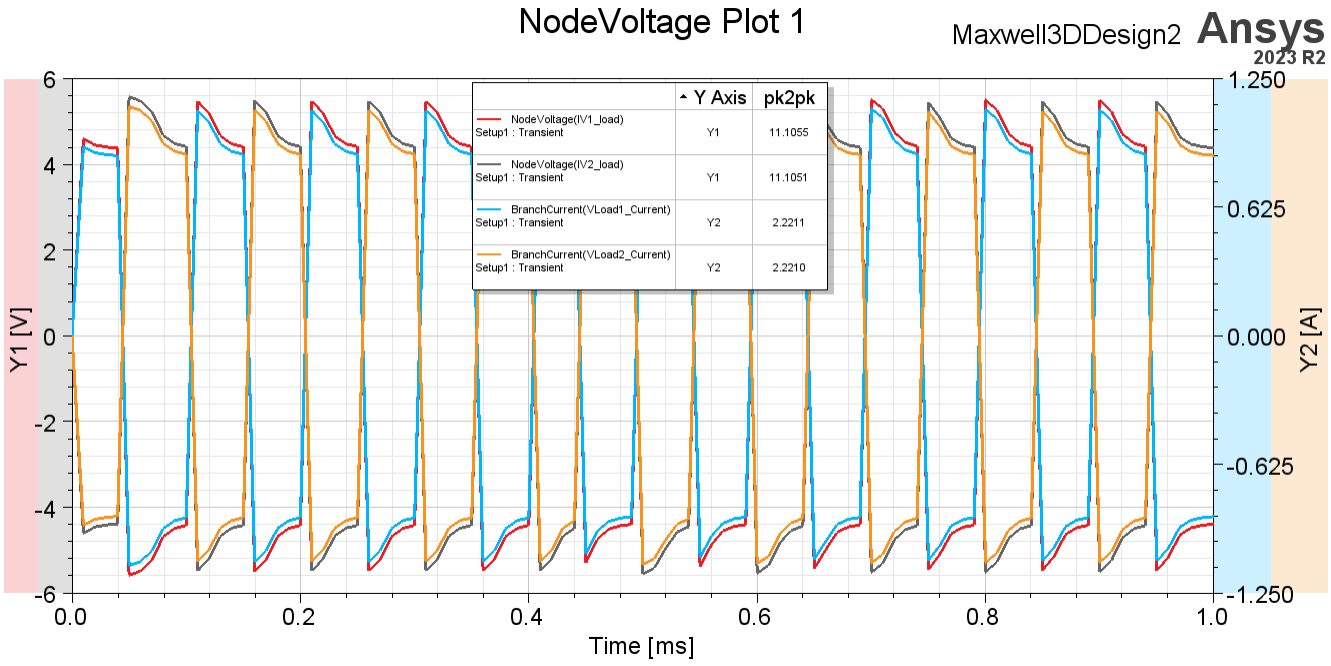
Stop=1mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns**, 60** Loop turns:



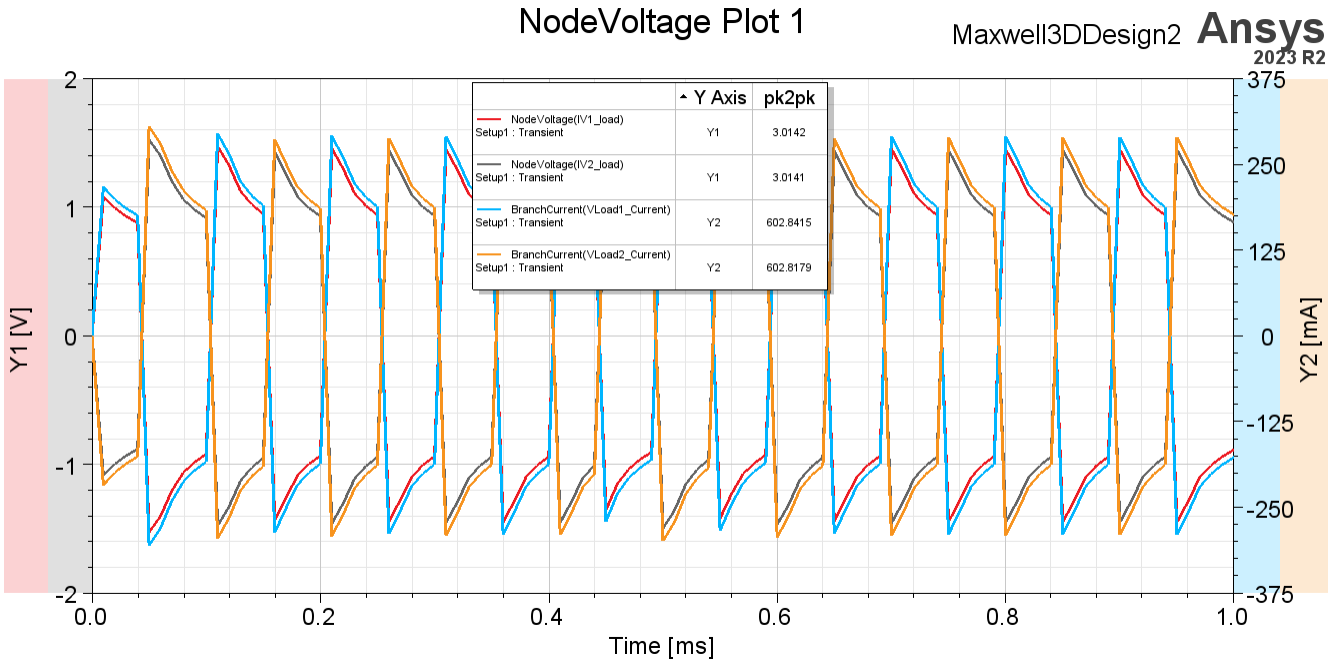
Stop=1mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns, **120** Loop turns:



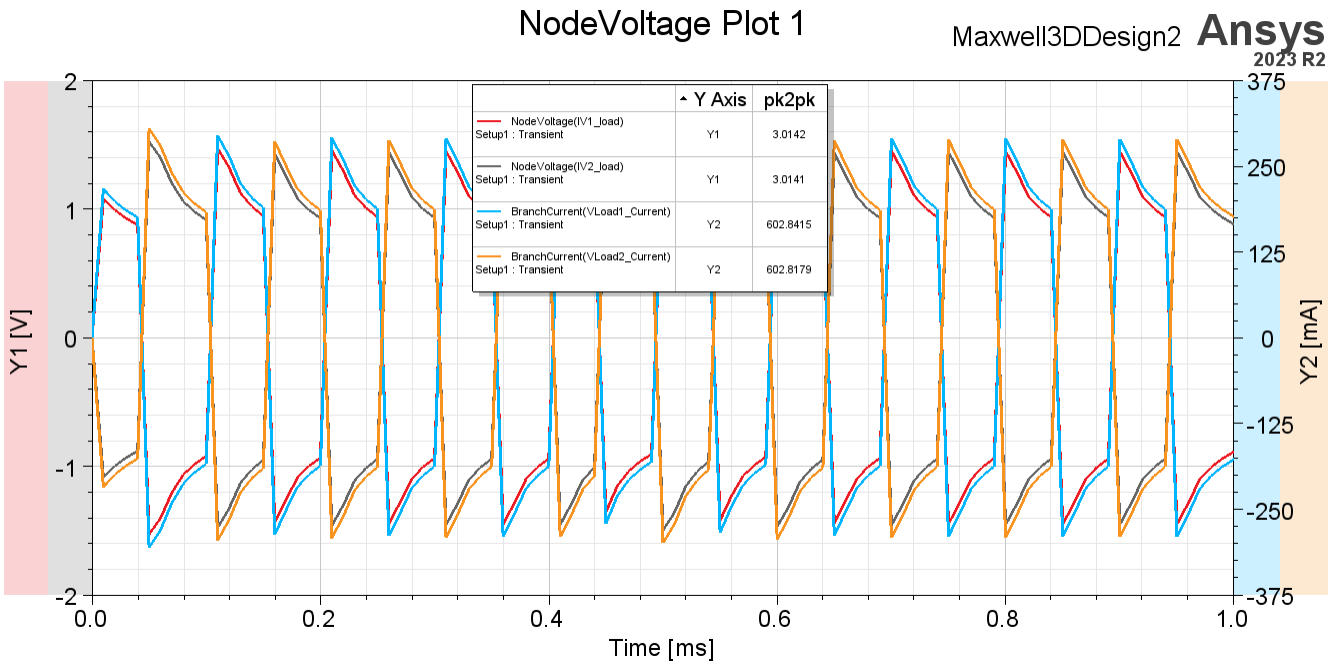
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns, **20** Loop turns:



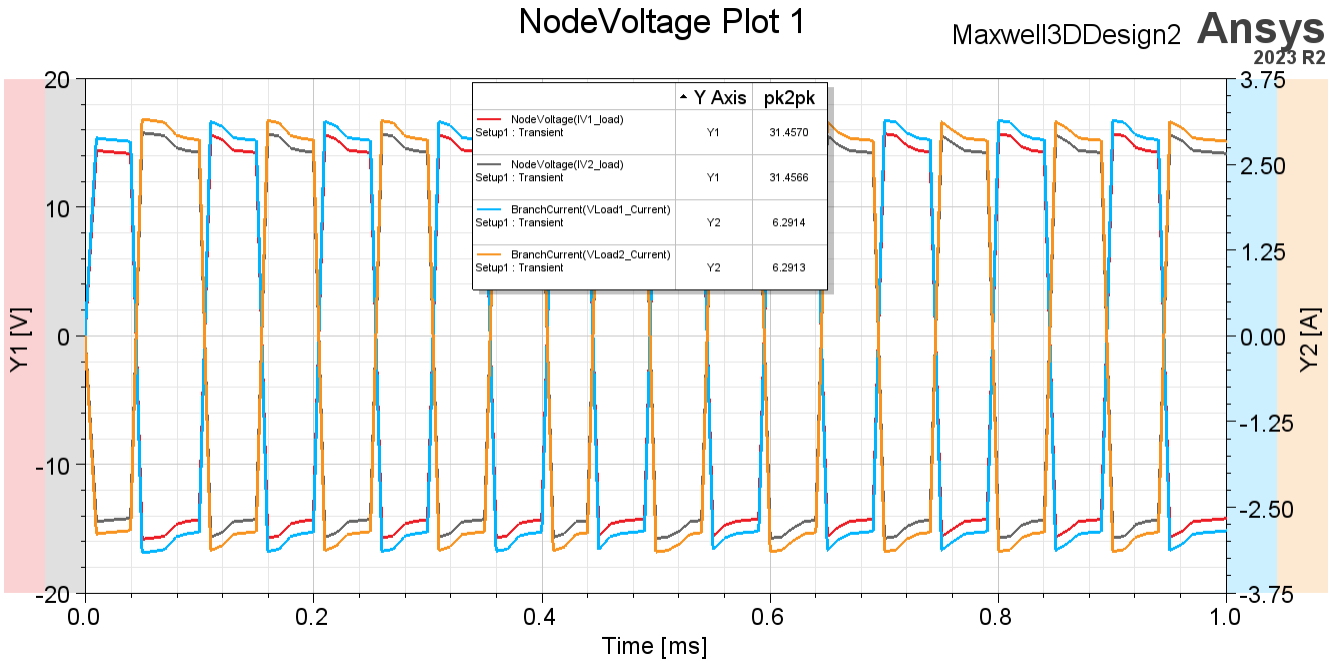
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **5** Coil turns, **20** Loop turns:



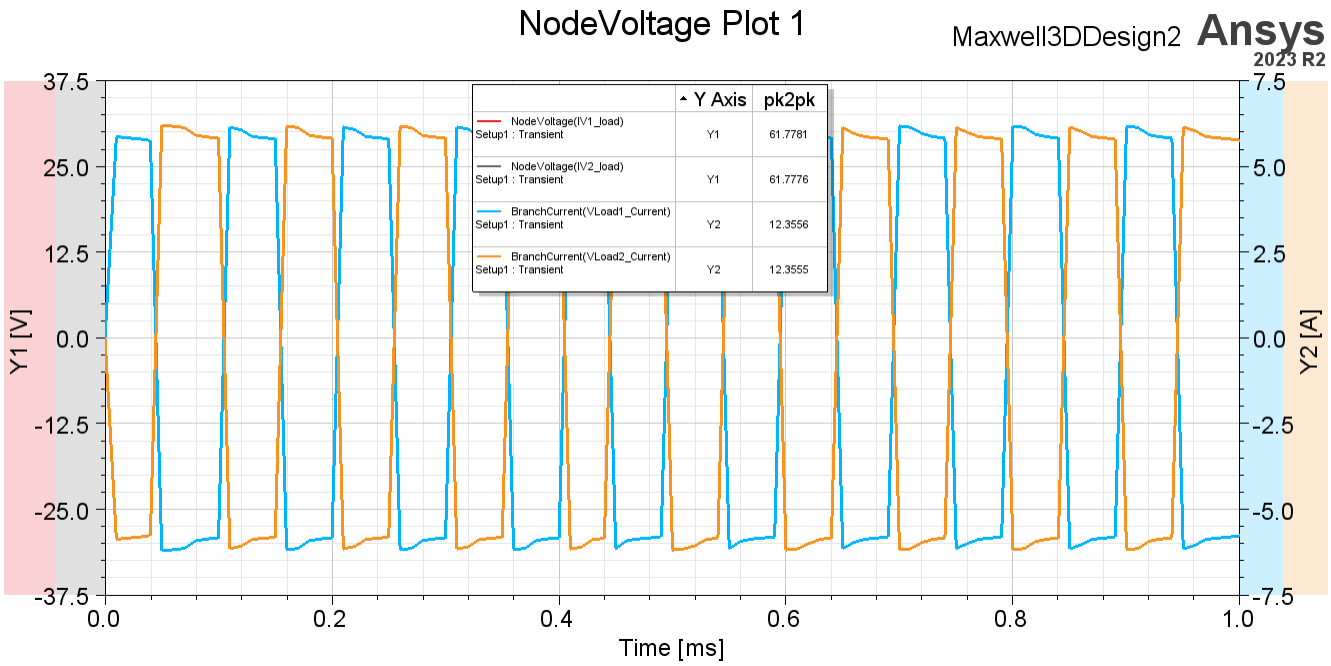
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **5** Coil turns, **120** Loop turns:



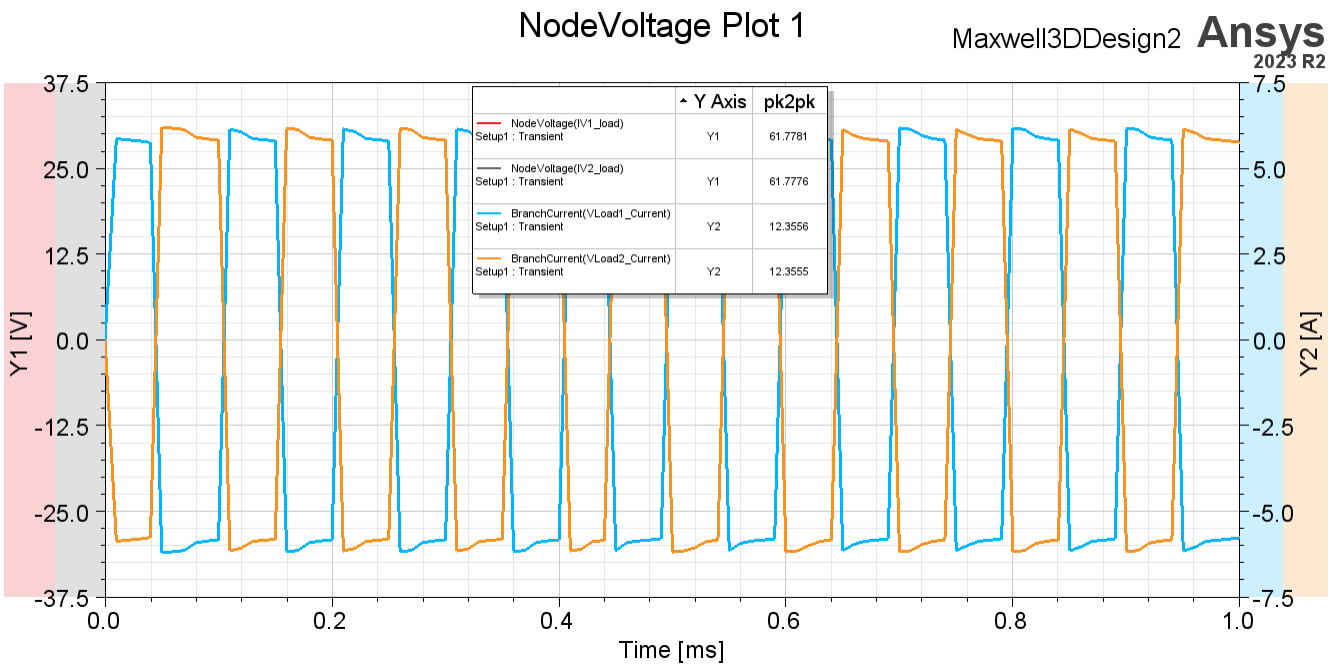
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **60** Coil turns, **120** Loop turns:



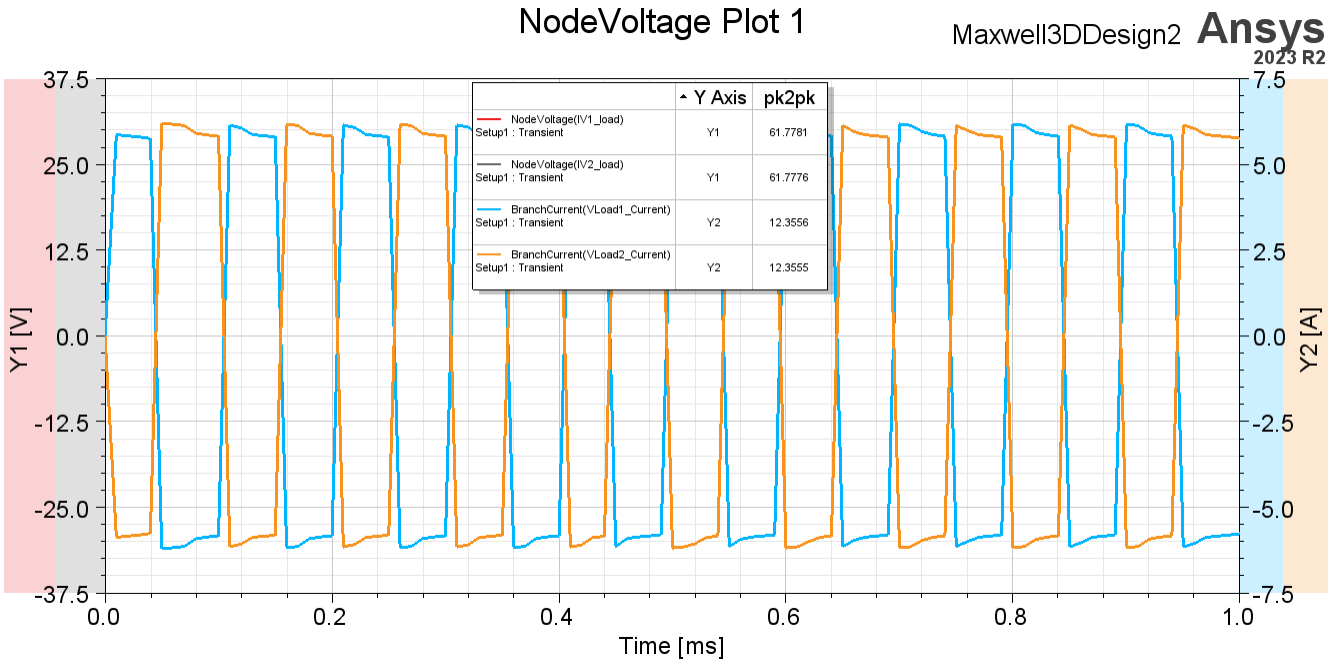
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **120** Coil turns, **120** Loop turns:



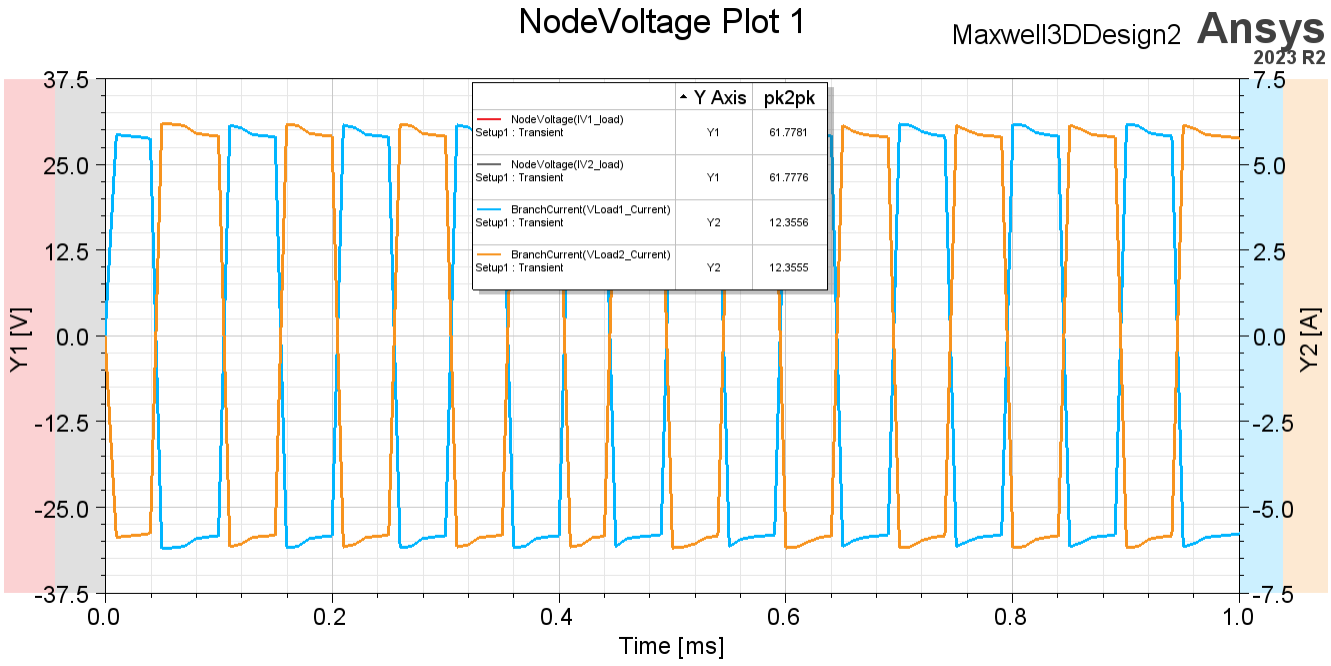
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **120** Coil turns, **60** Loop turns:



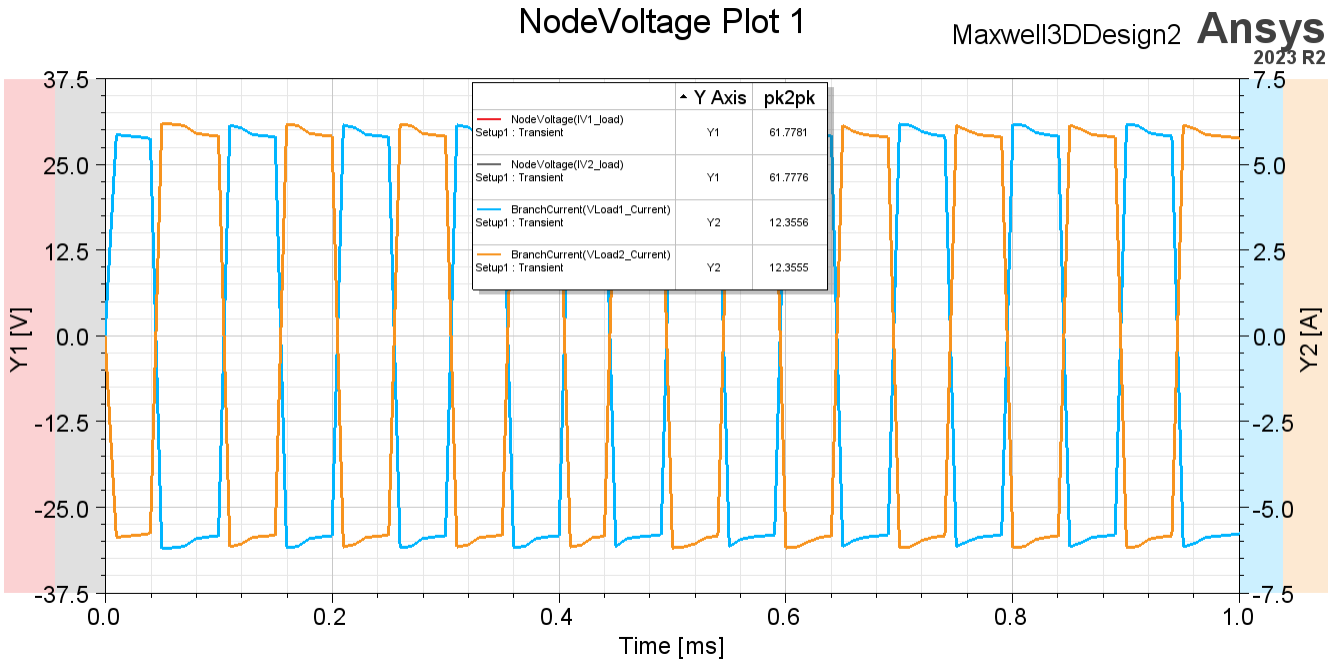
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **120** Coil turns, **6** Loop turns:



Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **120** Coil turns, **1** Loop turn:

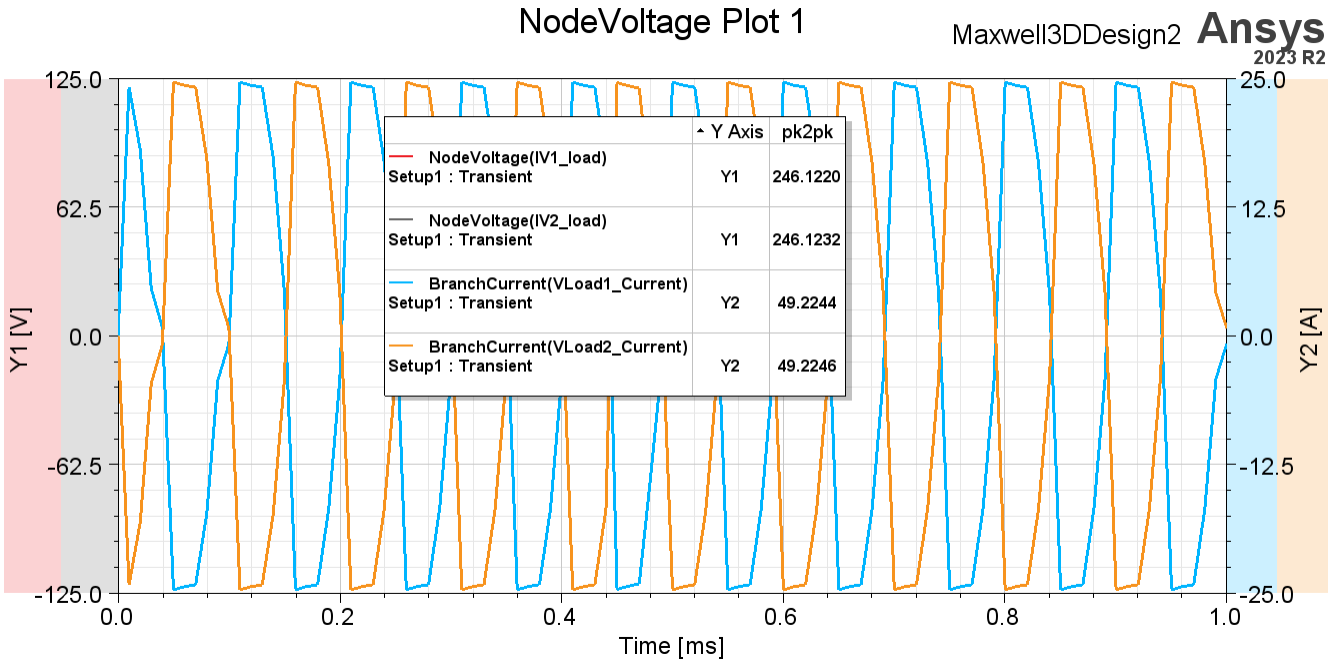


Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **120** Coil turns, **1000** Loop turns:



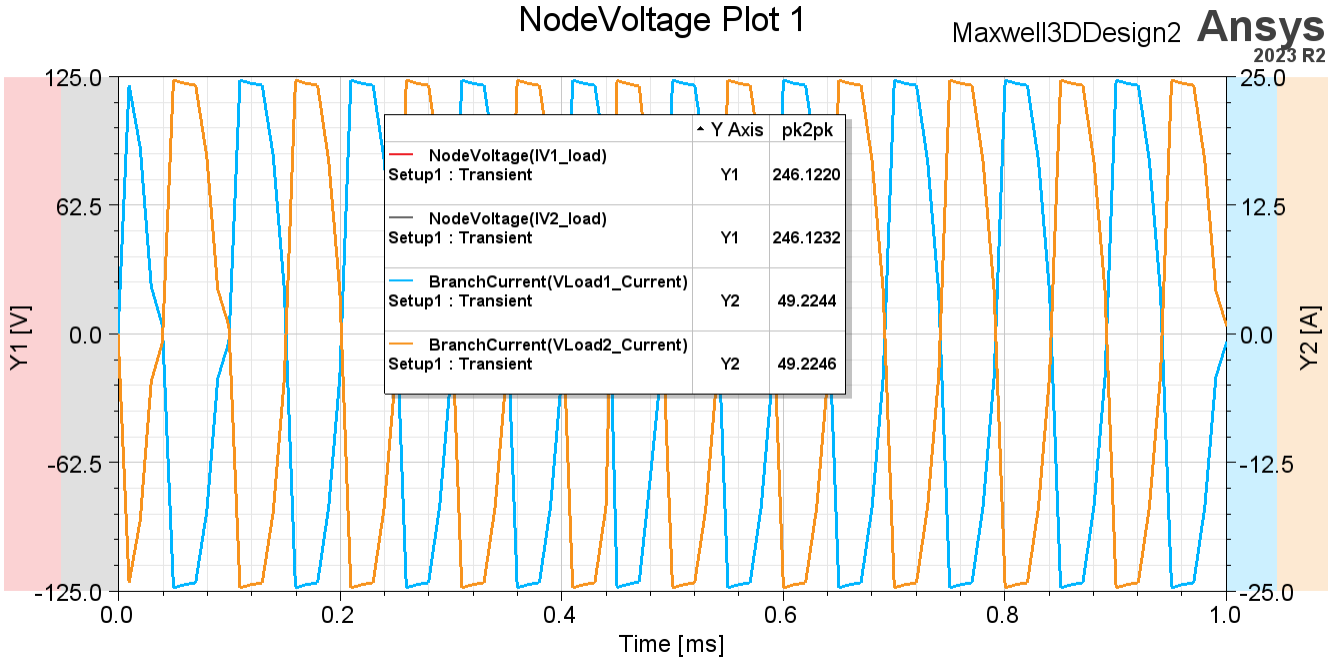
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **500** Coil turns, **1000** Loop turns:

{ 246Vpp X 49.2App = 12,054W X 2 Loops = 24,108 KW }



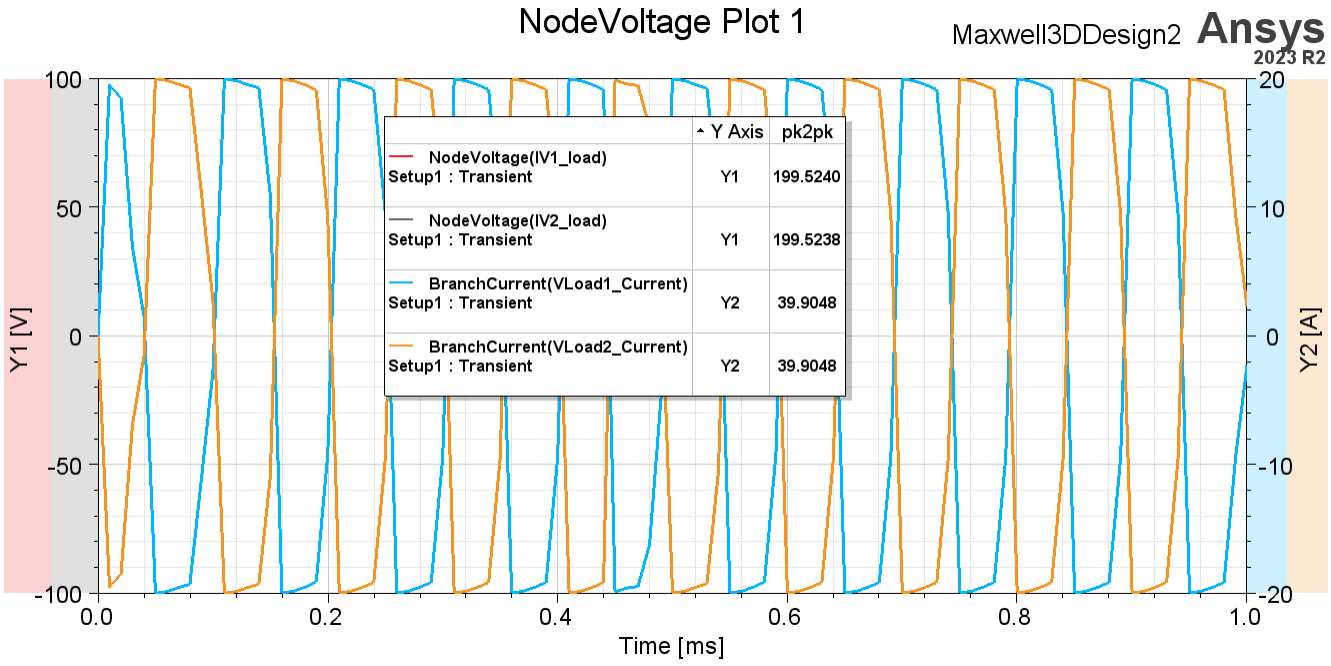
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **500** Coil turns, **1** Loop turn:

{ 246Vpp X 49.2App = 12,054W X 2 Loops = 24,108 KW }



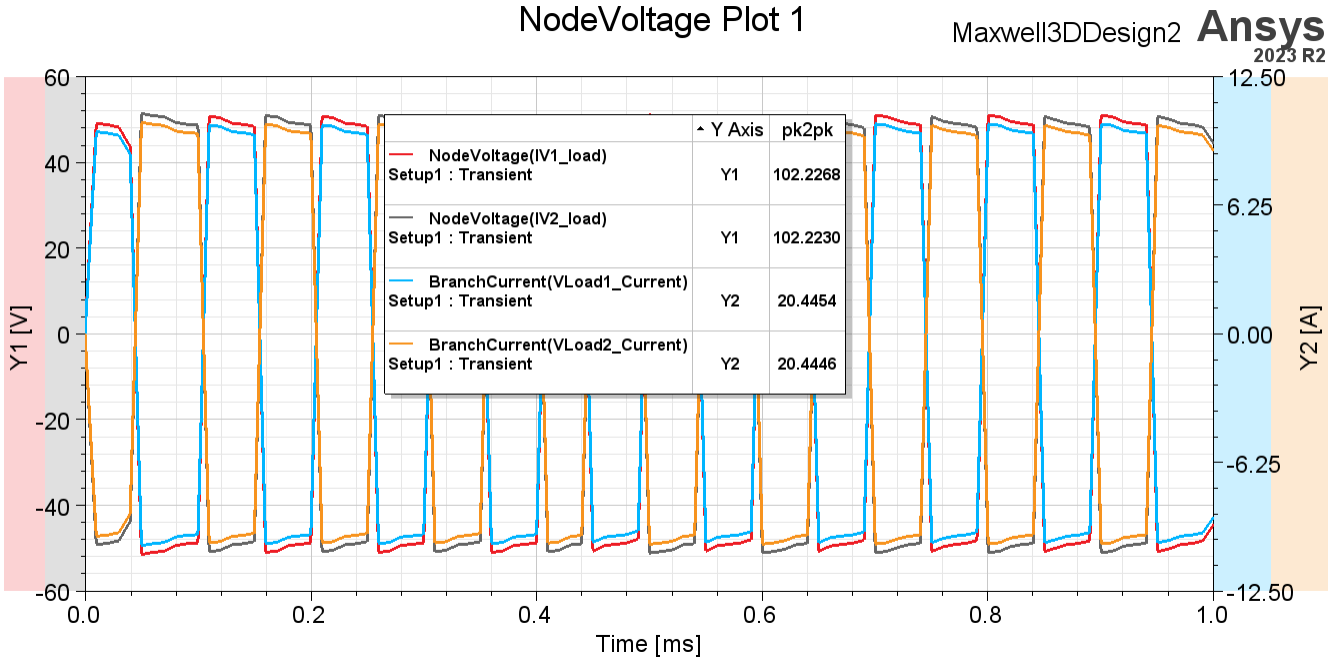
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **400** Coil turns, **1** Loop turn:

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



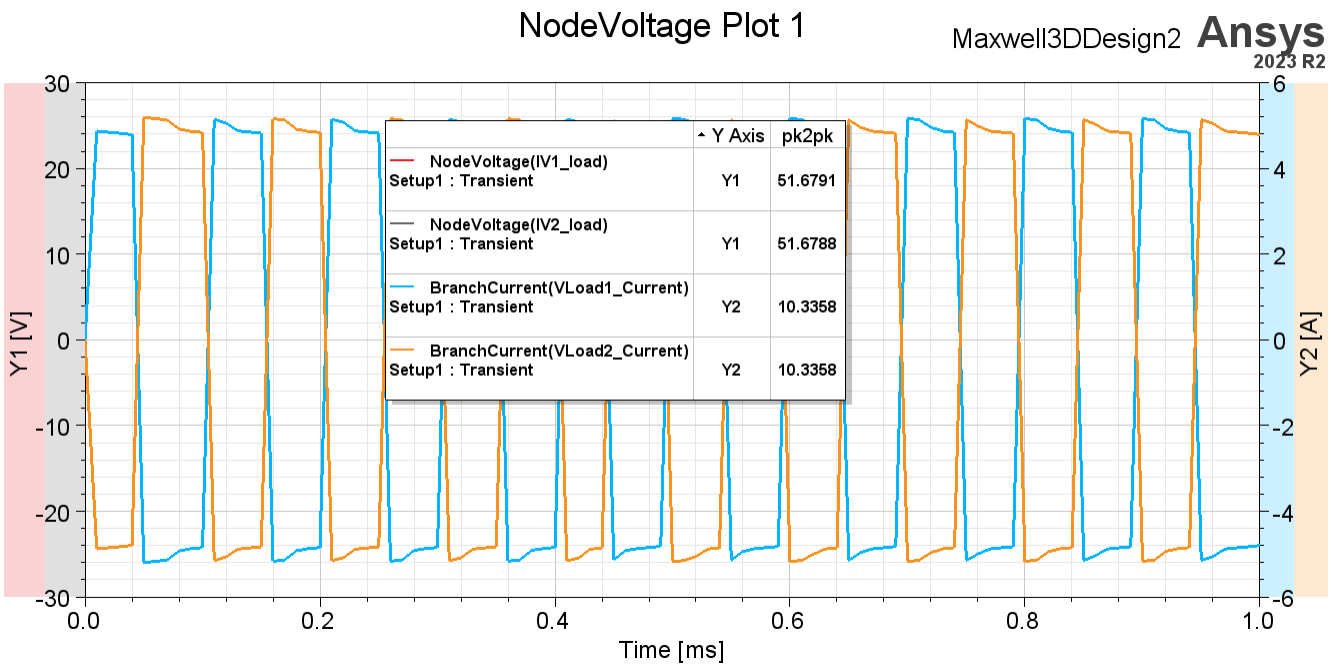
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **200** Coil turns, **1** Loop turn:

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



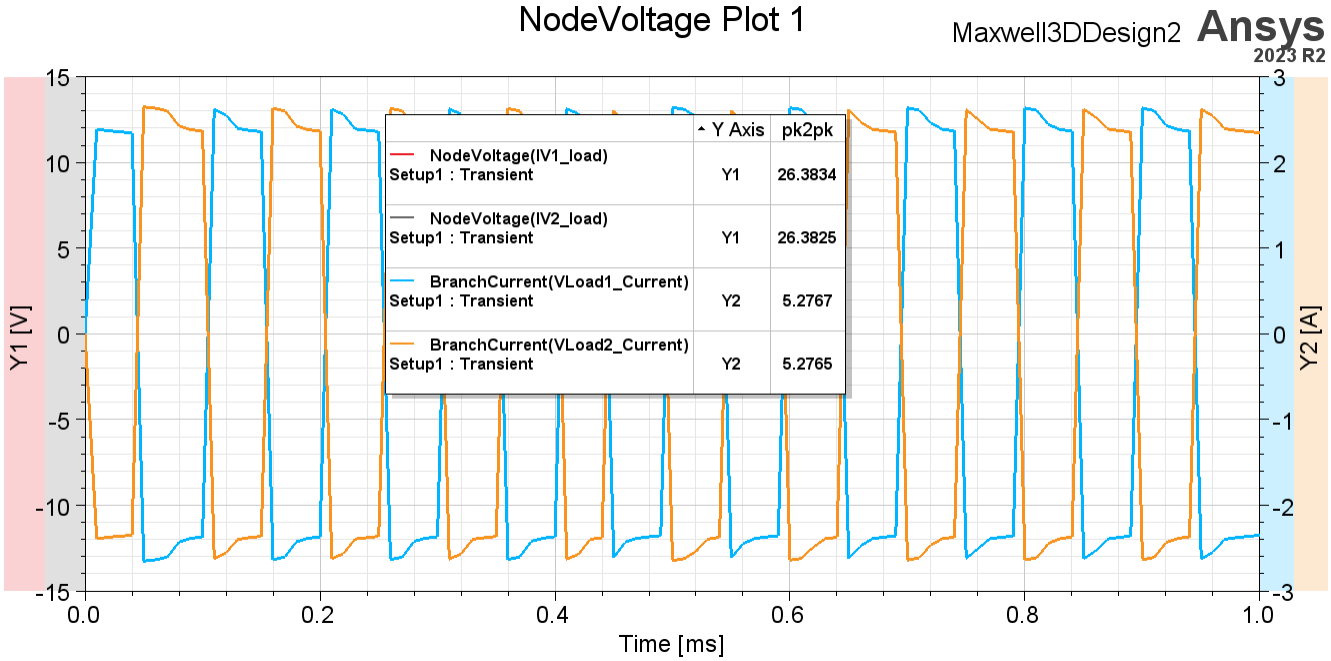
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **100** Coil turns, **1** Loop turn:

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



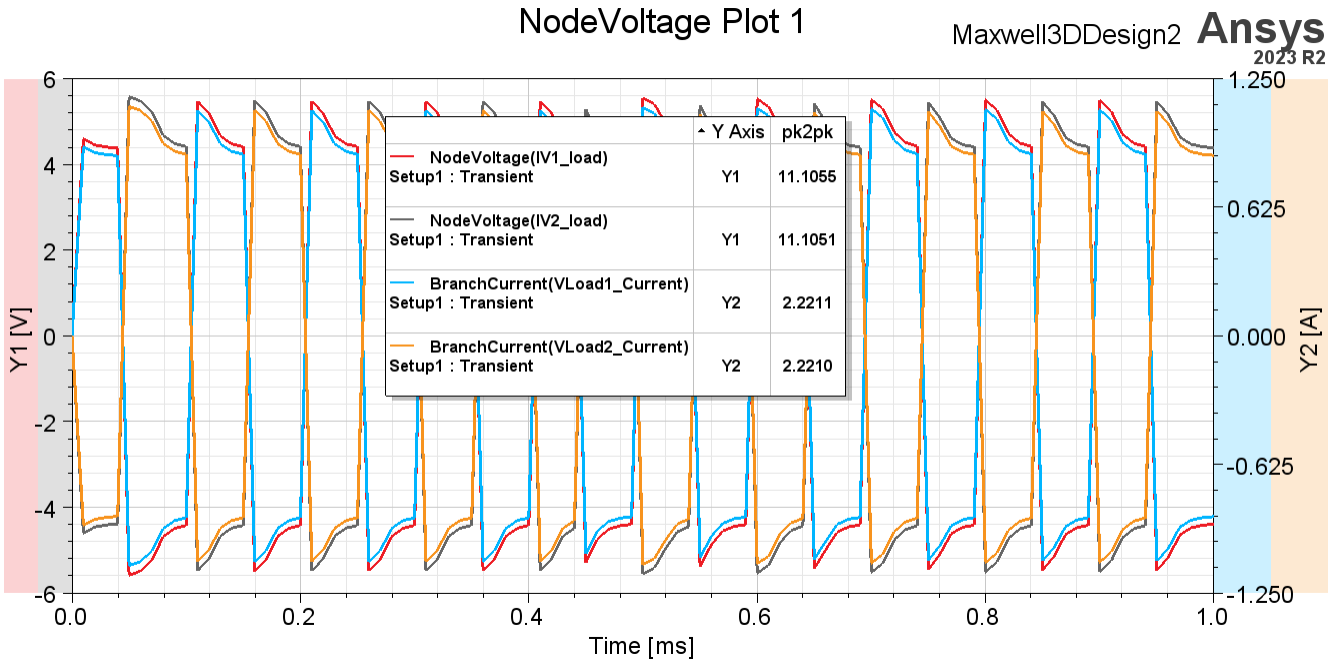
Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **50** Coil turns, **1** Loop turn:

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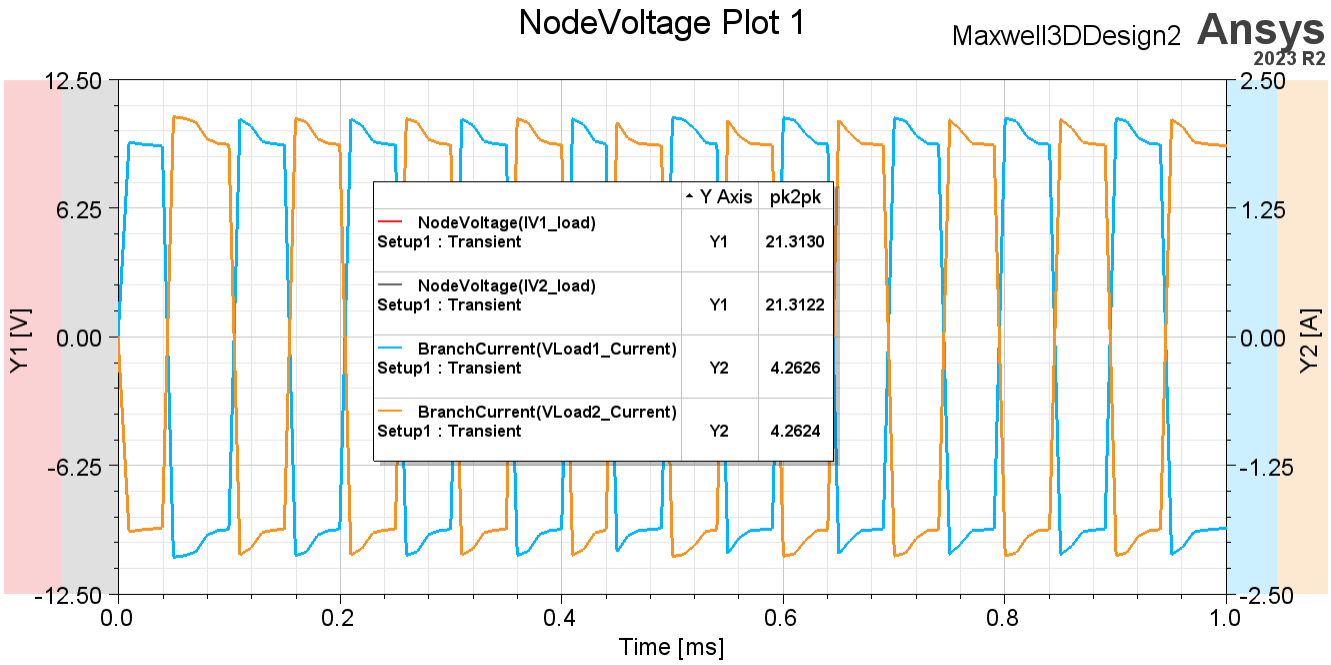
As a validation - **change the current in the circuit to +100mA/-100ma (200mA)**, everything else remains the same Stop=1 mS, Stime Step=0.01, Pwidth=0.05mS, Pperiod=0.1mS; **20** Coil turns, **1** Loop turn:

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



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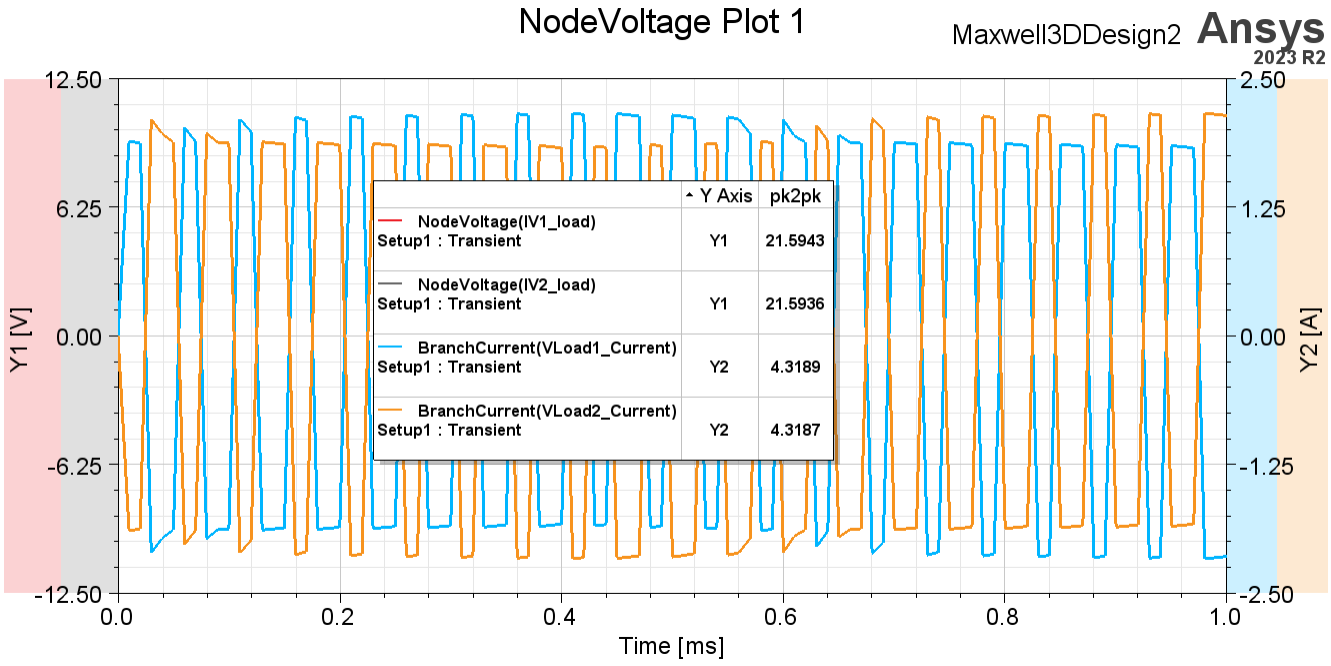
Change the Frequency from 10Hz to 20Hz (Pwidth=0.025mS, Pperiod=0.05mS) Leave the rest the same.

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



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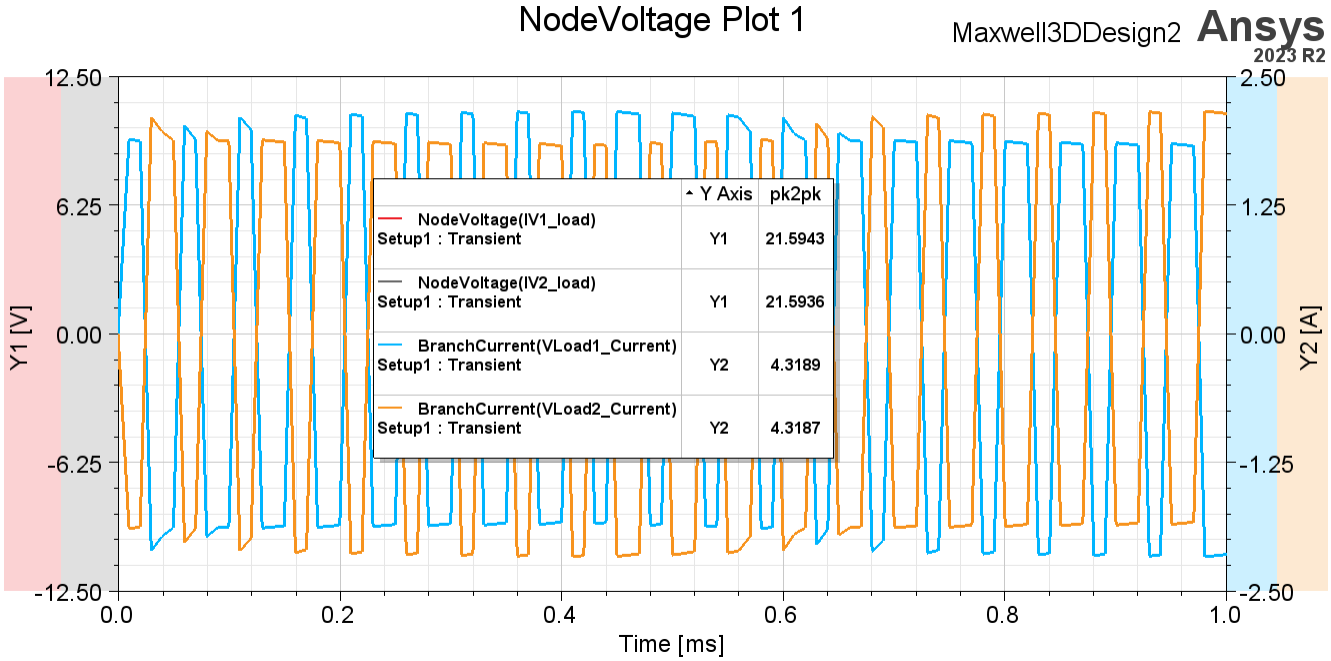
Frequency 20Hz, Coil turns = 20, Loop turns = 50

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



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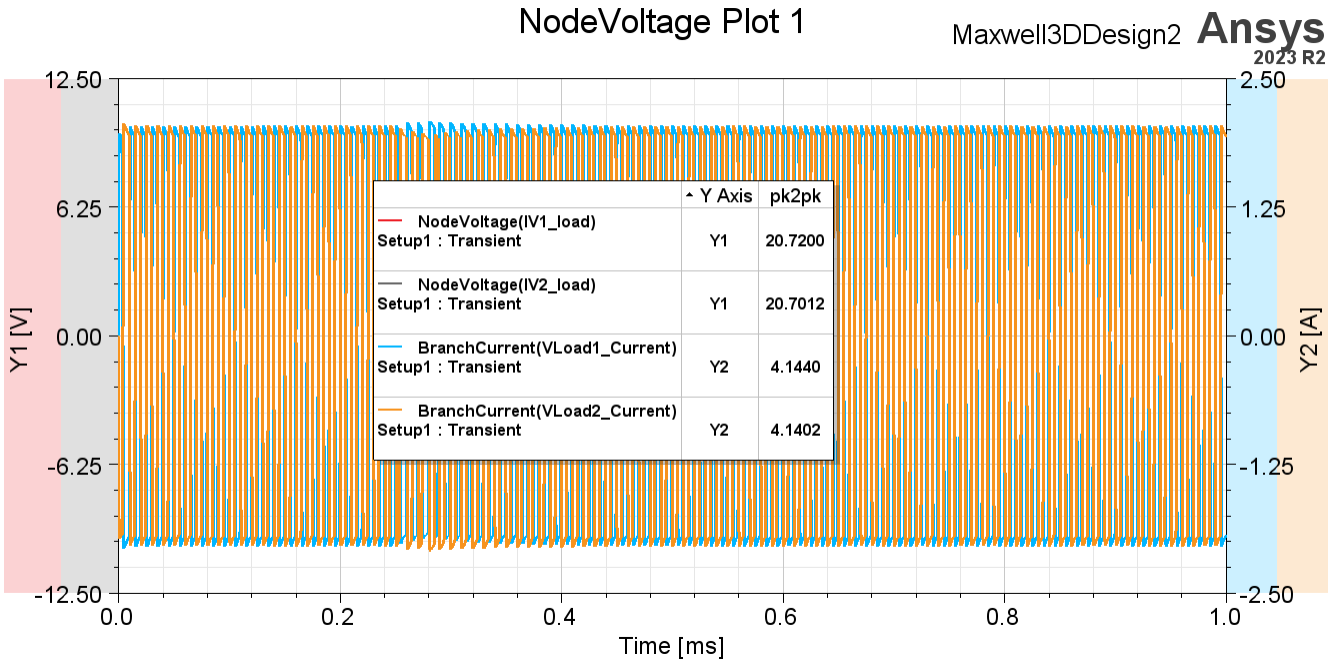
Frequency 100Hz [Pwidth=0.005mS ,Pperiod=0.01mS],
Coil turns = 20, Loop turns = 50; **Drive = +100mA/-100mA (200mA)**

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



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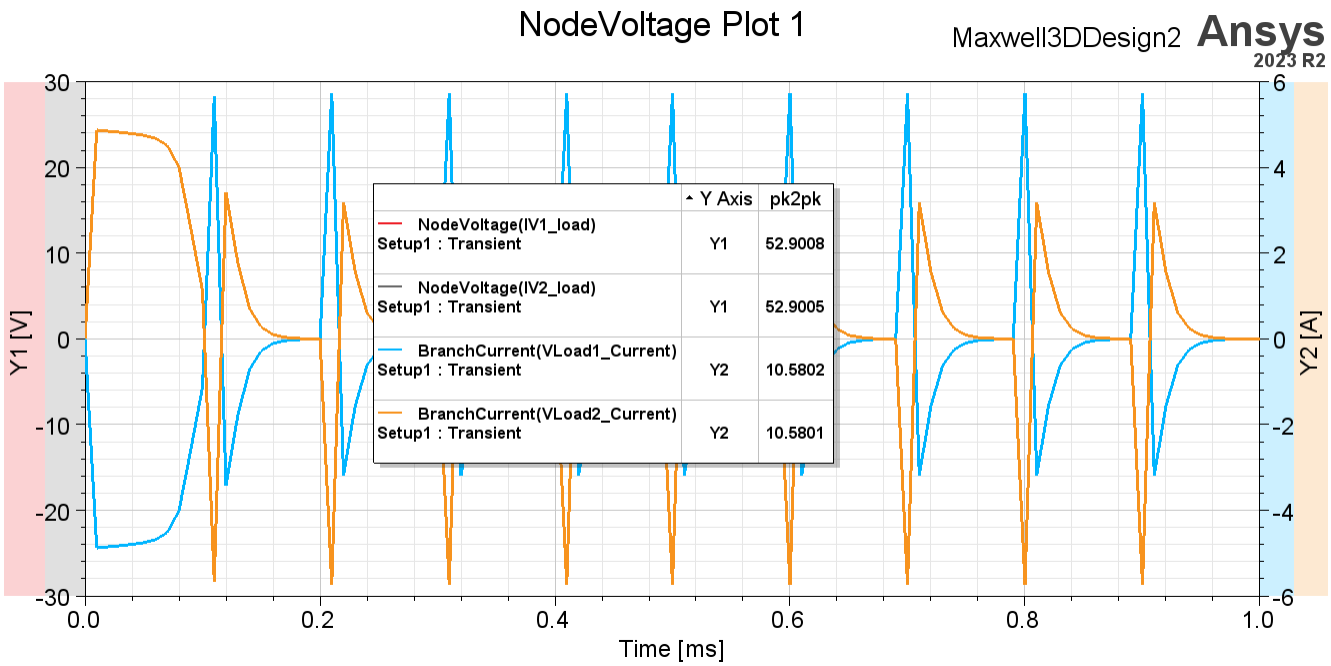
Return to: Stop=1 mS, Stime Step=0.01, ~~Pwidth=0.05mS, Pperiod=0.1mS~~; Drive back to +/- 50mA (100mA)
100 Coil turns, **1** Loop turn:

Test Duty Cycle Pwidth=0.01mS, Pperiod=0.1mS {Flip Pw=0.9mS Pp=0.1mS - same output inverted}



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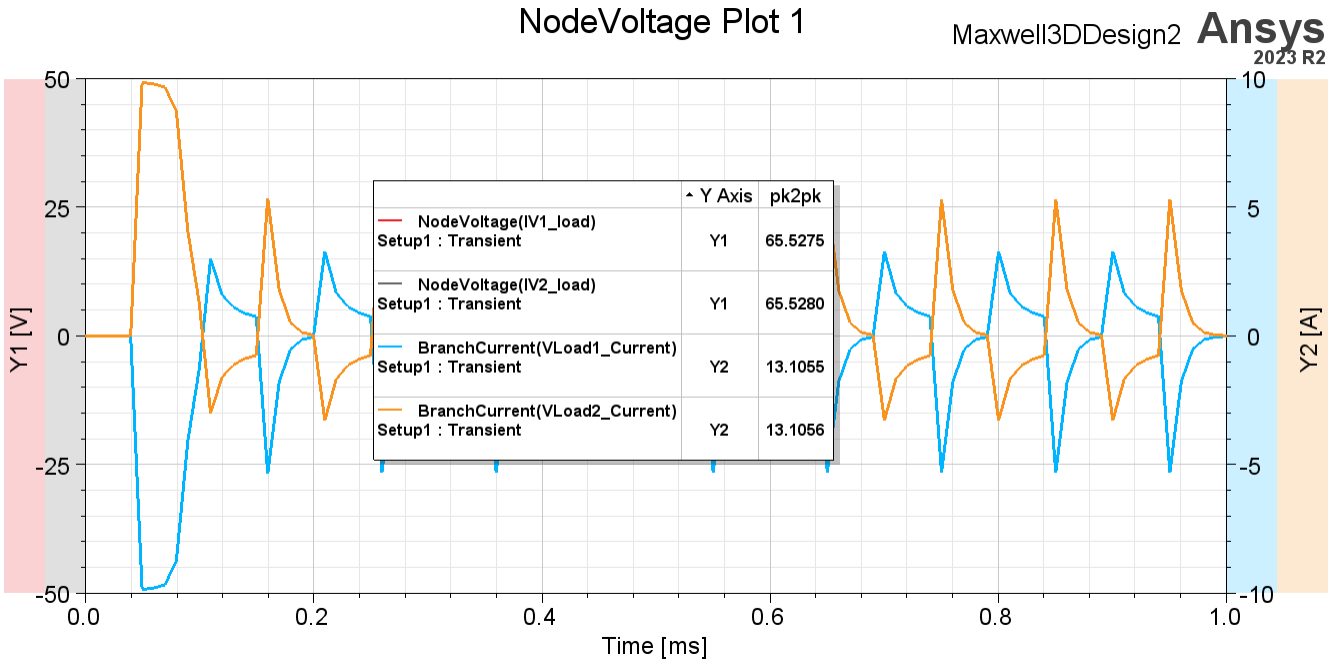
Single ended Input - +100mA & 0mA, 50% duty cycle.



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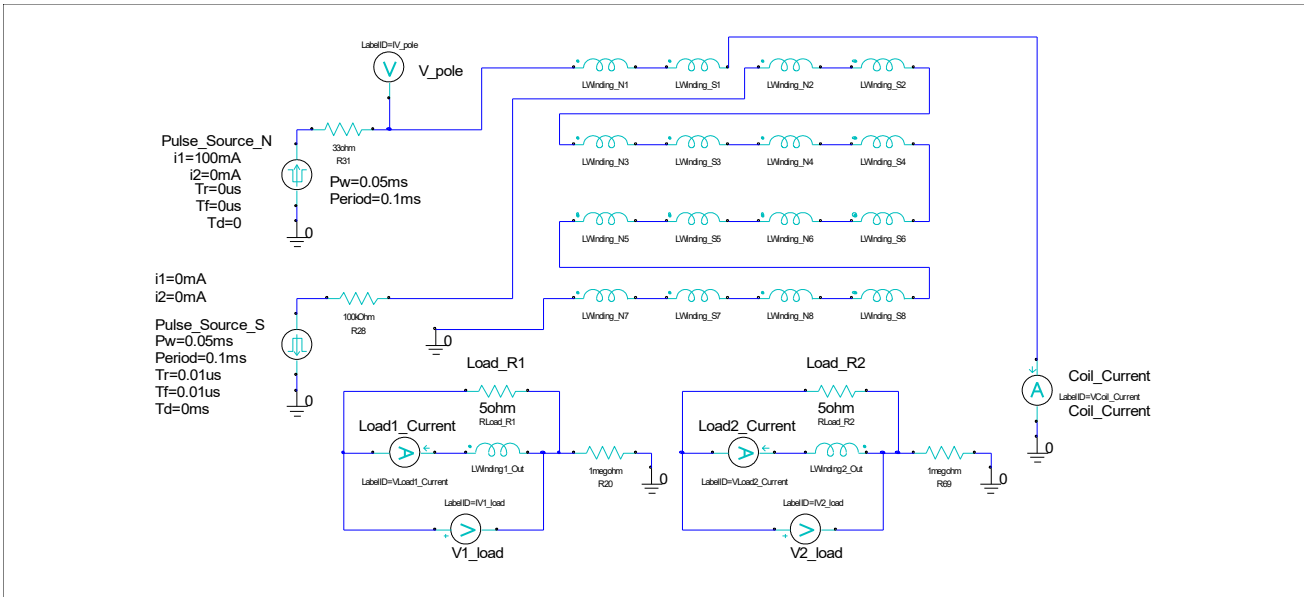
========== ADD EACH POLE IN SEQUENCE ==========



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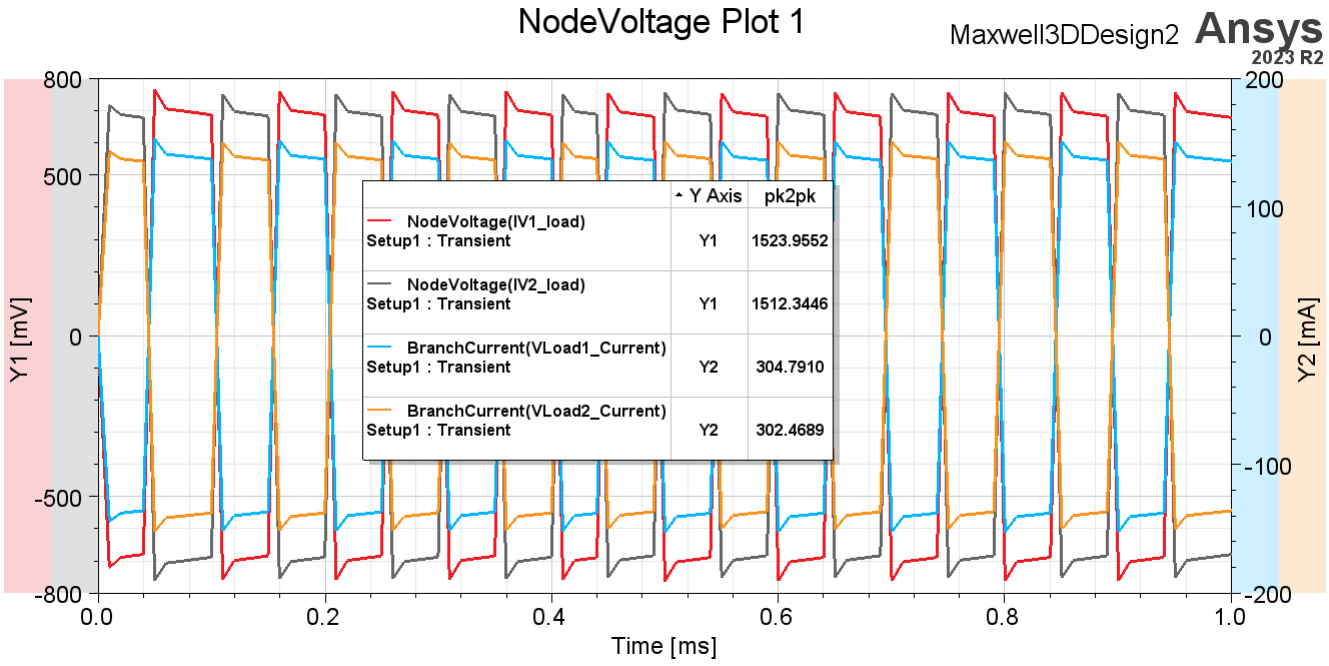
1 of 8 POLES:

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 }



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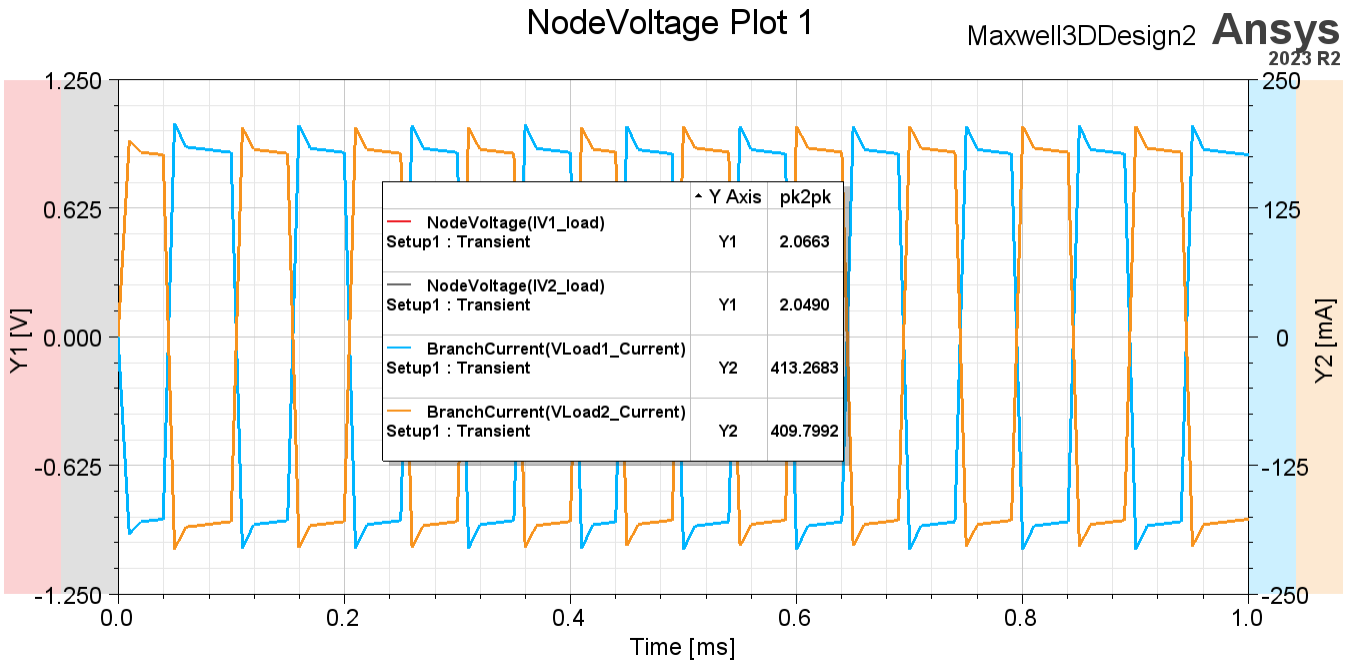
2 of 8 POLES:

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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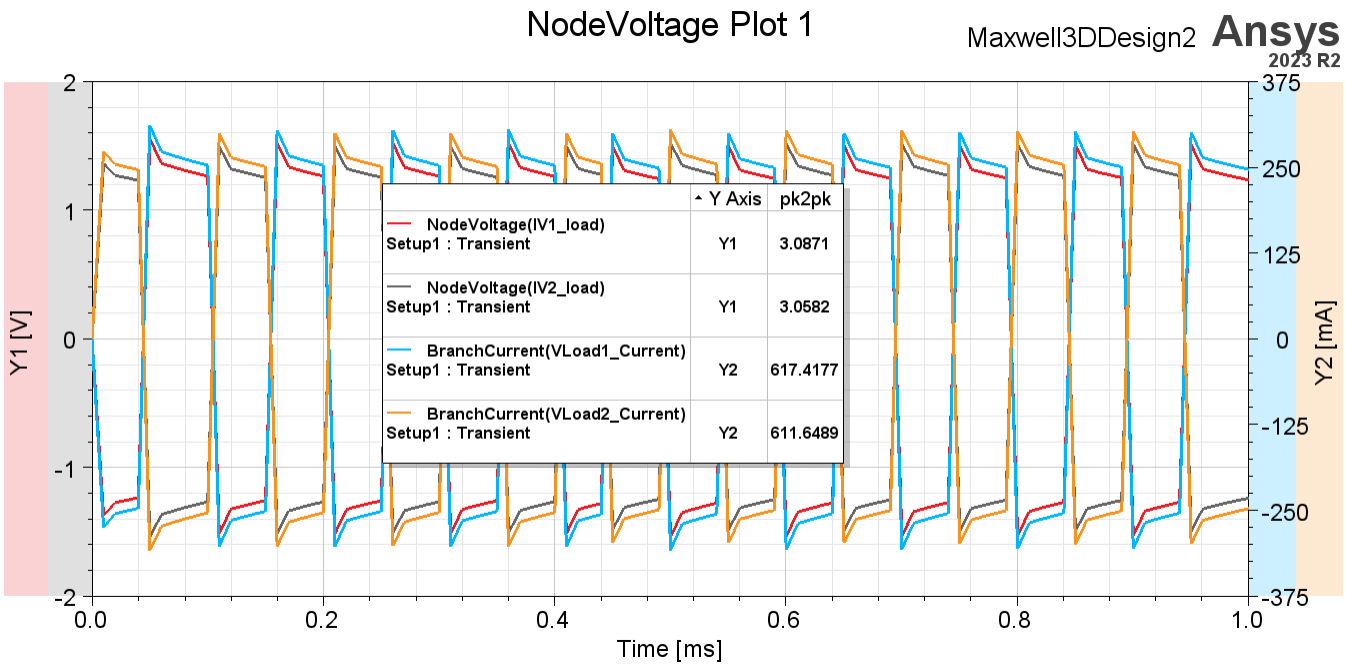
3 of 8 POLES:

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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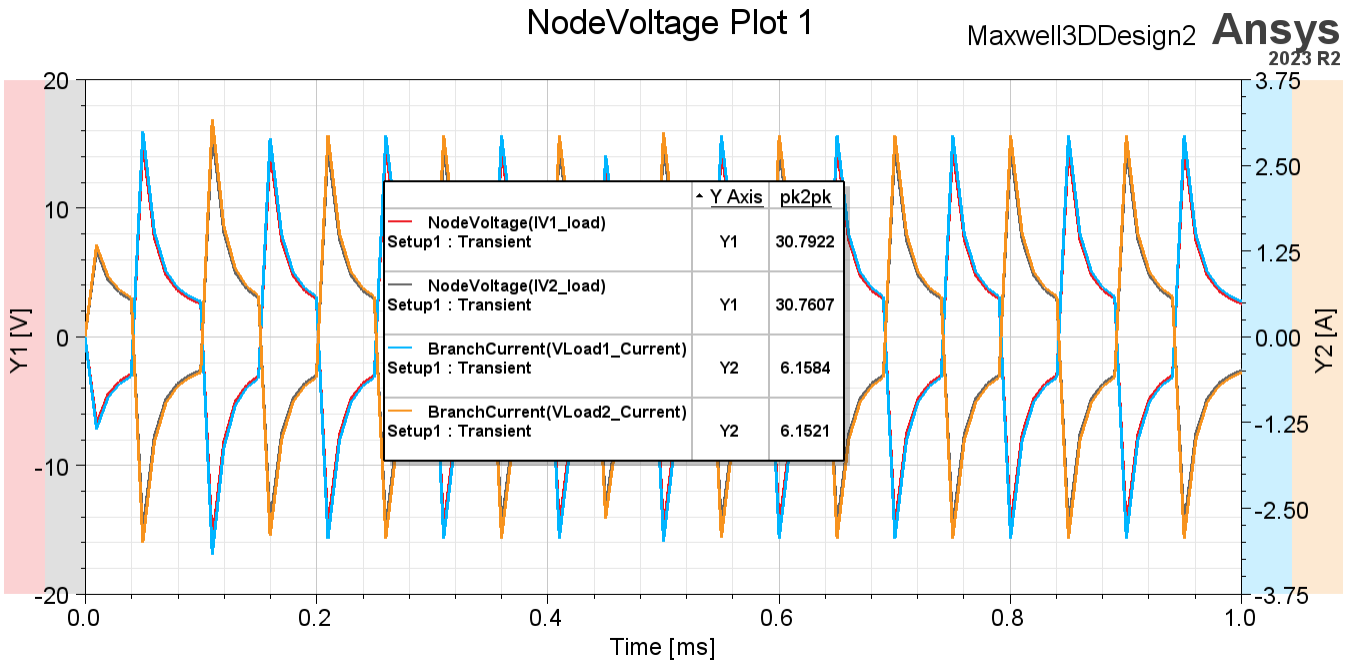
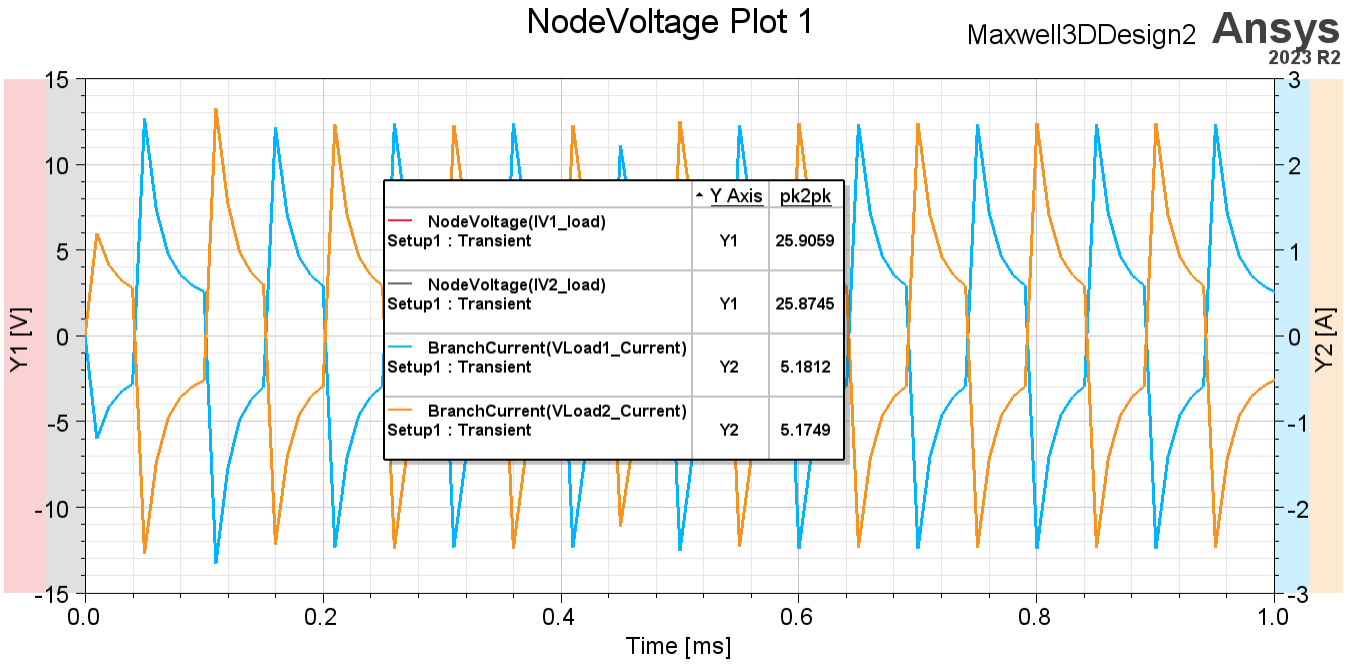
4 of 8 POLES:

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 }



Drop back to Coil turns = 80:



REQUITES A CLOSER LOOK - Cause unknown at the moment!

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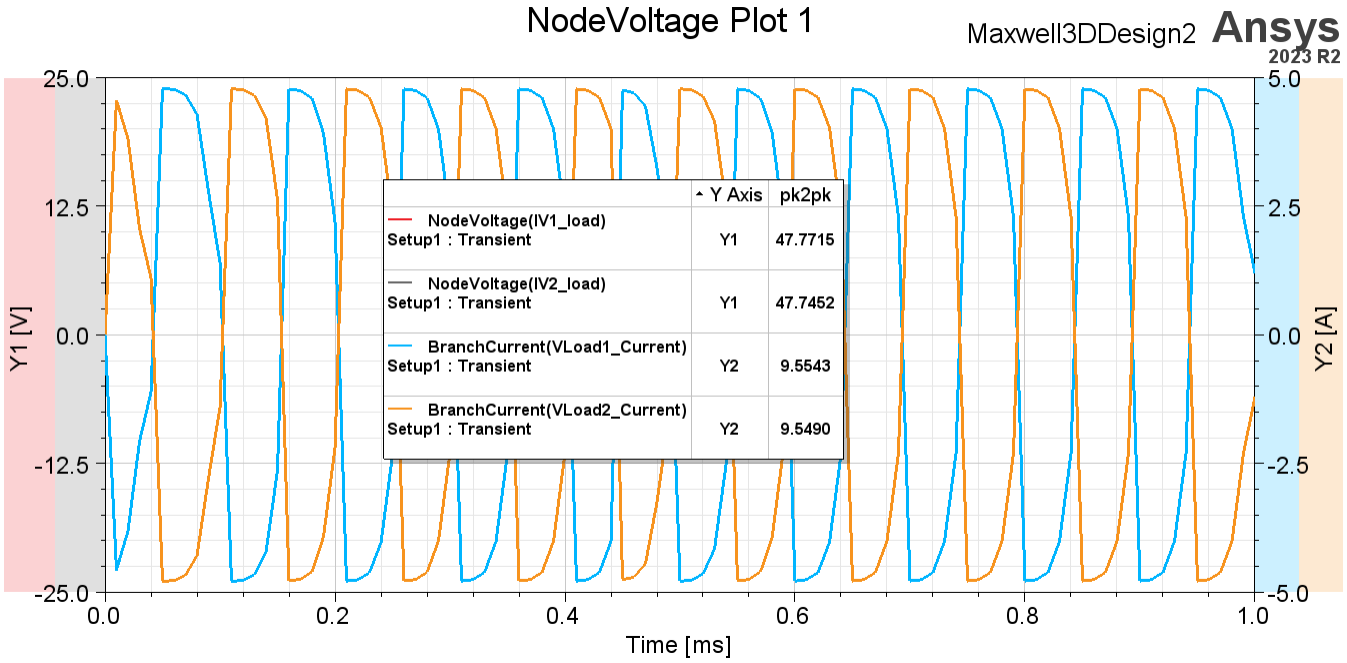
5 of 8 POLES:

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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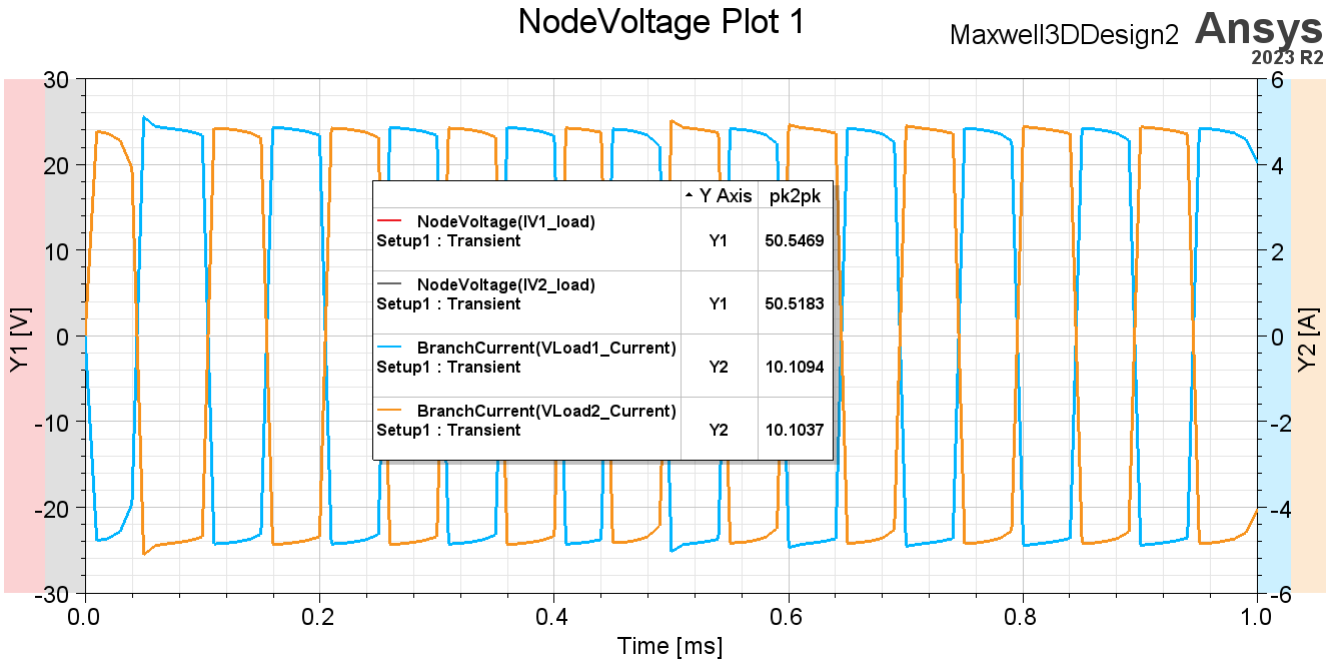
6 of 8 POLES:

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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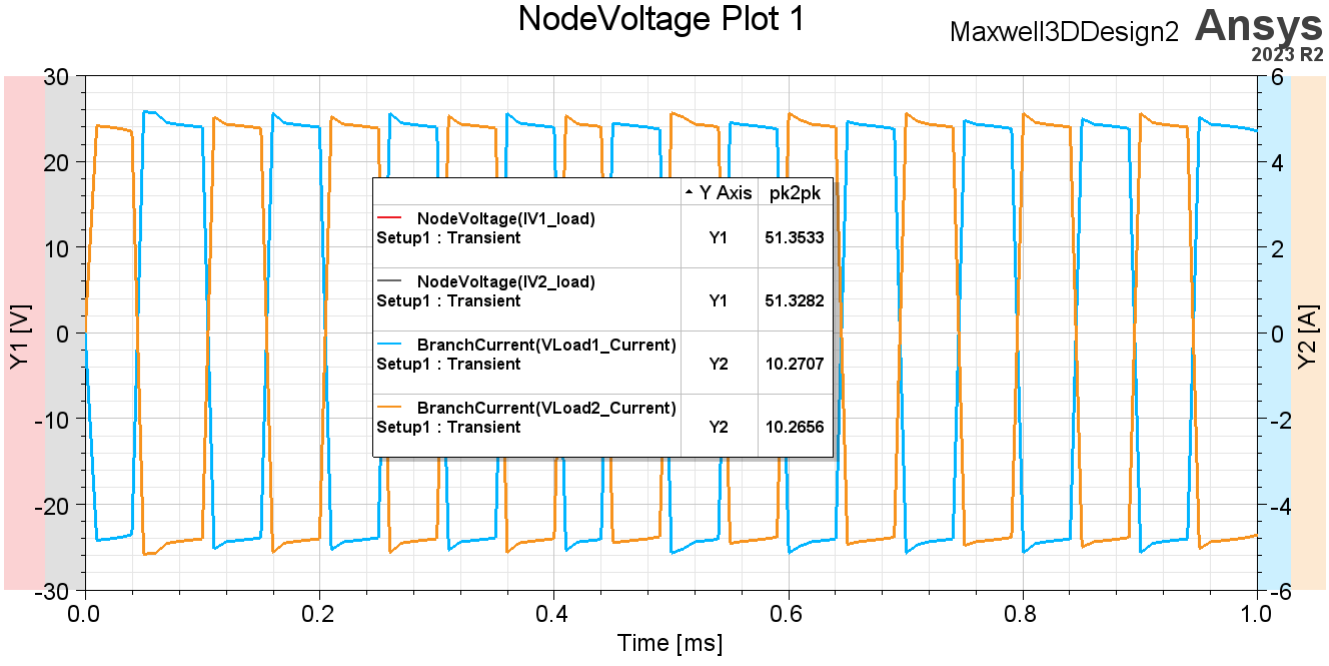
7 of 8 POLES:

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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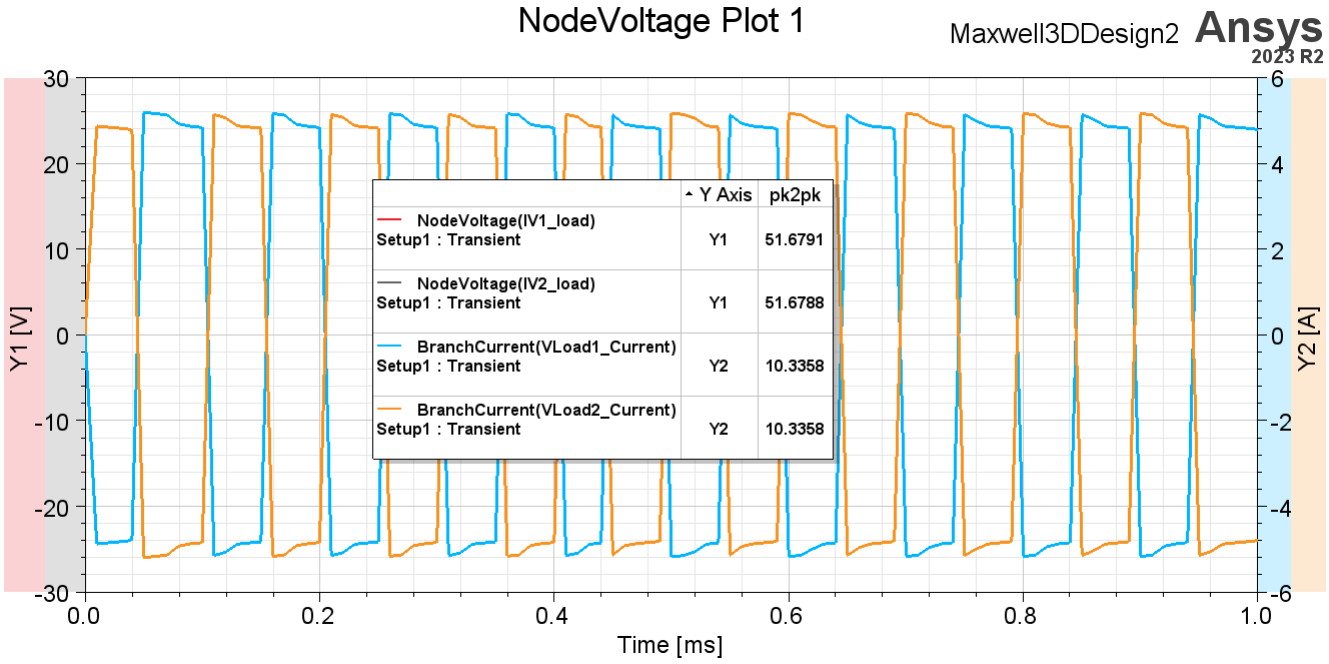
8 of 8 POLES:

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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SL (solarlab) 30 December 2023