pmsm_outrunner_18s16p - Machine Report

Topology: PMSM - Outrunner
Generated: 2026-08-22 21:07:04 by Nabla

Operating point

Mechanical speed: 2.000e+04 RPM
Electrical frequency: 2667 Hz
Simulated steps: 91 (field step 91)

All values are read from the selected completed simulation. Missing or non-finite quantities are shown as "-".

Machine Parameters

Operating Point

Parameter	Value	Unit	Comments
Mechanical Speed	20000.0	RPM	
Electrical Frequency	2666.67	Hz	

DQ Quantities

Parameter	Value	Unit	Comments
D-axis Inductance (Ld)	57.5363	uH	
Q-axis Inductance (Lq)	76.8848	uH	
Saliency Ratio	0.748344	-	Ld/Lq

Flux and Voltage / Back-EMF

Parameter	Value	Unit	Comments
PM Flux Linkage 1st Harmonic Peak	0.00539577	Wb	
Back-EMF 1st Harmonic Peak	92.2222	V	peak of the fundamental
Back-EMF RMS	65.2457	V	fundamental + harmonics
Back-EMF THD	3.26582	%	percent of the fundamental
Phase Voltage 1st Harmonic Peak	93.4447	V	peak of the fundamental
Phase Voltage RMS	66.1211	V	fundamental + harmonics

Torque and Mechanical Performance

Parameter	Value	Unit	Comments
Average Torque	0.387459	N.m	
Torque Ripple (Peak-to-Peak)	0.0267305	N.m	
Torque Ripple	6.89893	%	percent of average torque
Cogging Torque (Peak-to-Peak)	0.0192865	N.m	
Torque Constant (Kt)	0.0645765	N.m/A	

Power and Efficiency

Parameter	Value	Unit	Comments
Apparent Power	0.841213	kVA	S = V * I (RMS)
Active Power	0.838496	kW	P = V * I * cos(phi)
Reactive Power	0.0675631	kVA	Q = V * I * sin(phi)
Mechanical Power	0.811492	kW	from average torque
Efficiency	90.4005	%	
Power Factor	0.996769	-	
Back-EMF Constant (Ke)	0.0446166	V.s/rad	
Back-EMF Constant (Ke krpm)	4.67224	V/krpm	

Losses

Parameter	Value	Unit	Comments
Joule Losses (Winding)	26.6539	W	
Current Density	7.53892	A/mm^2	
Phase Resistance	493.590	mOhm	

Parameter	Value	Unit	Comments
Slot Fill Factor	0.400000	-	
Iron Losses (Stator)	59.5058	W	
Iron Losses (Rotor)	0.0113129	W	
Total Losses	86.1710	W	

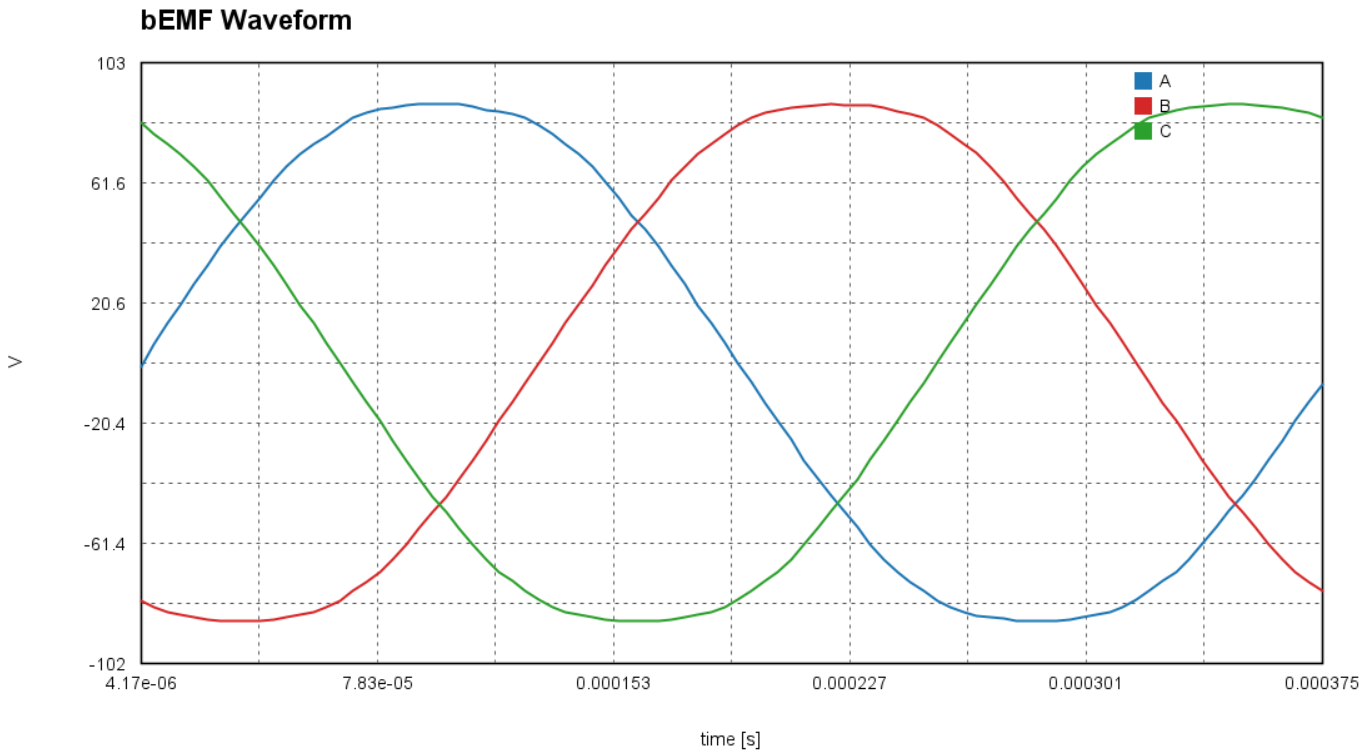
Flux Density Values

Parameter	Value	Unit	Comments
Max Flux Density (Stator Core)	0.792263	T	
Max Flux Density (Stator Tooth)	1.94086	T	
Max Flux Density (Rotor Core)	0.666017	T	

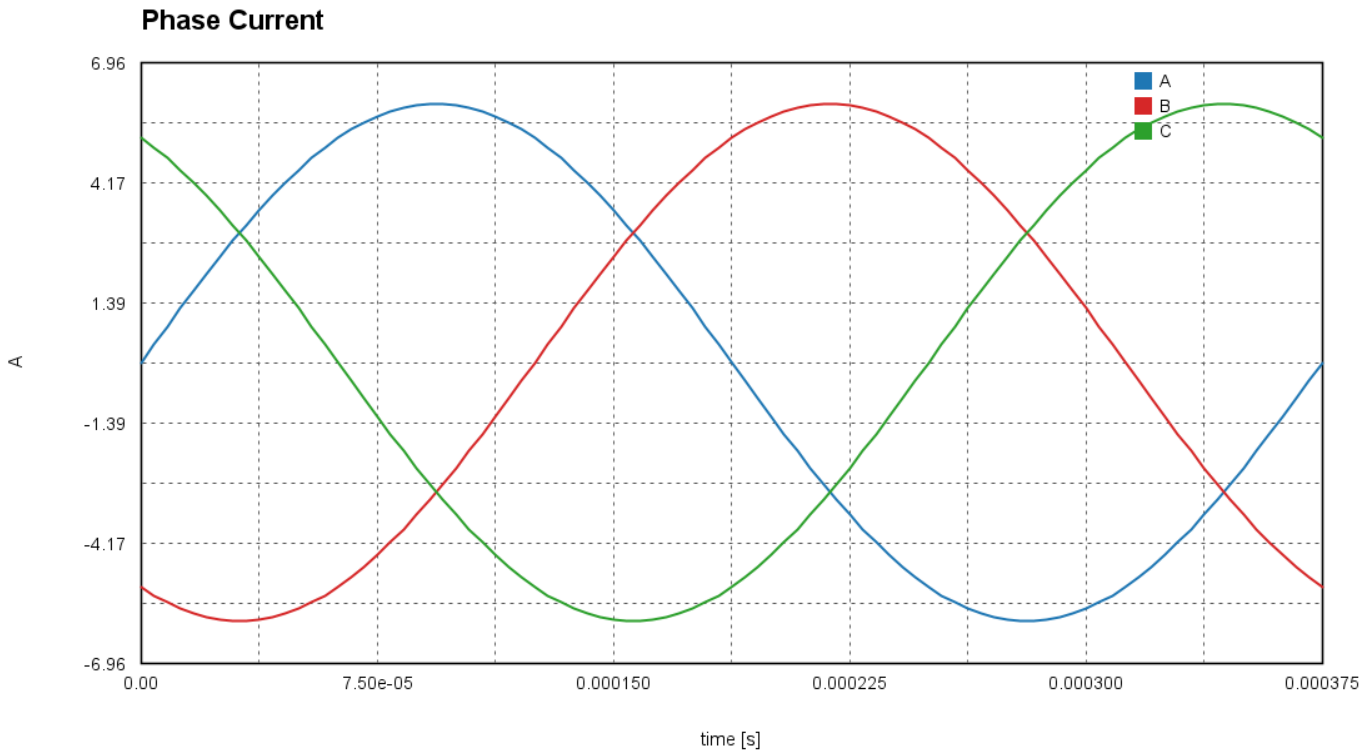
Mass Estimation

Parameter	Value	Unit	Comments
Stator Core Mass	0.0691810	kg	area x axial length x density
Rotor Core Mass	0.0480976	kg	
Winding Mass (In-Slot)	0.0145054	kg	slot area x fill factor
End-Winding Mass	0.0243328	kg	analytical, both axial ends
Magnet Mass	0.121685	kg	
Sleeves / Wedges / Spacers Mass	0.00346218	kg	
Total Mass	0.281264	kg	sector scaled to full machine

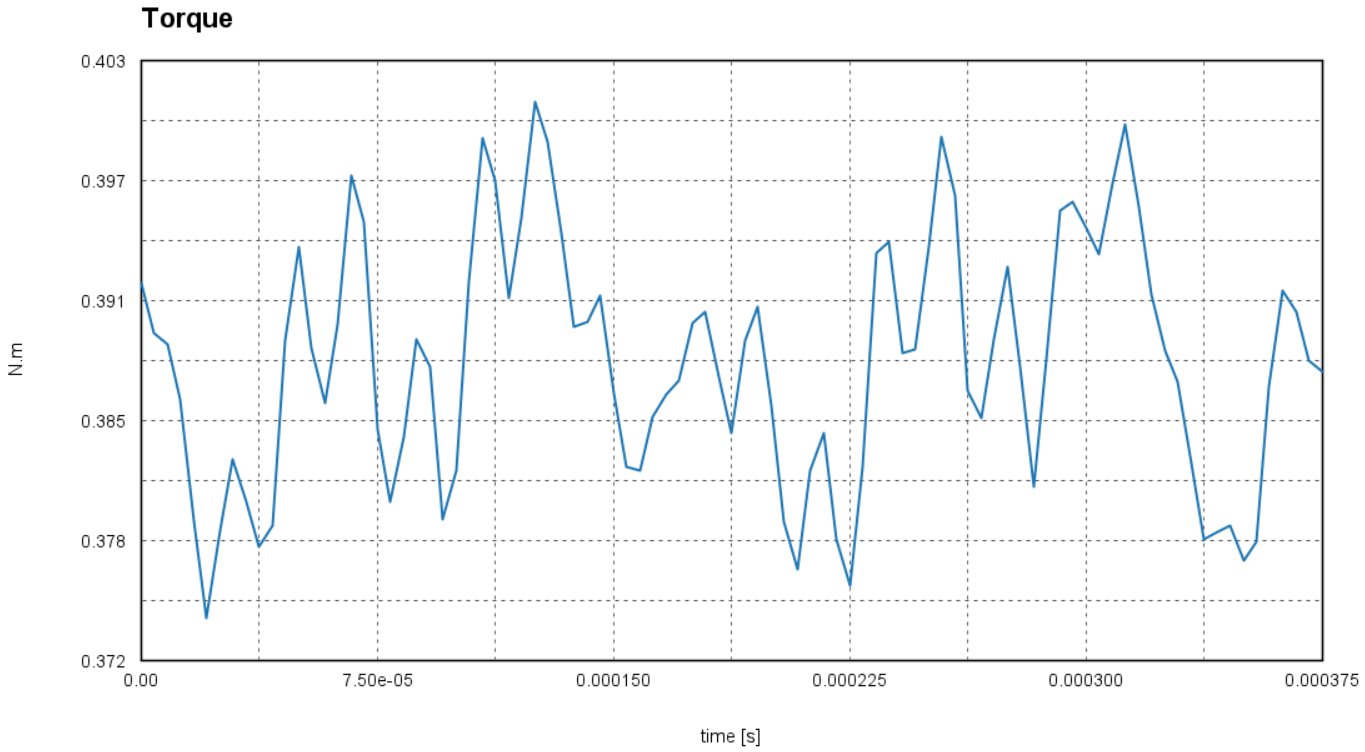
Key Waveforms



Full simulated range (90 samples). y-axis: V.

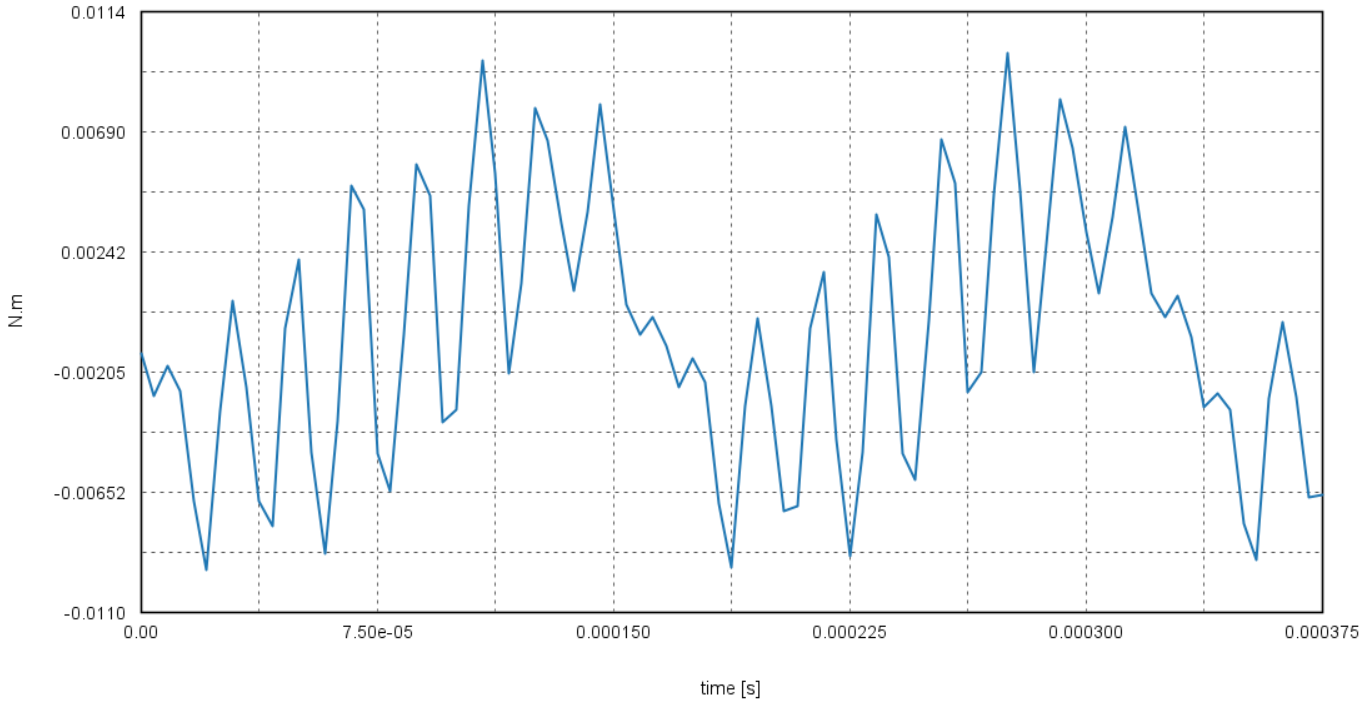


Full simulated range (91 samples). y-axis: A.



Full simulated range (91 samples). y-axis: N.m.

Cogging Torque

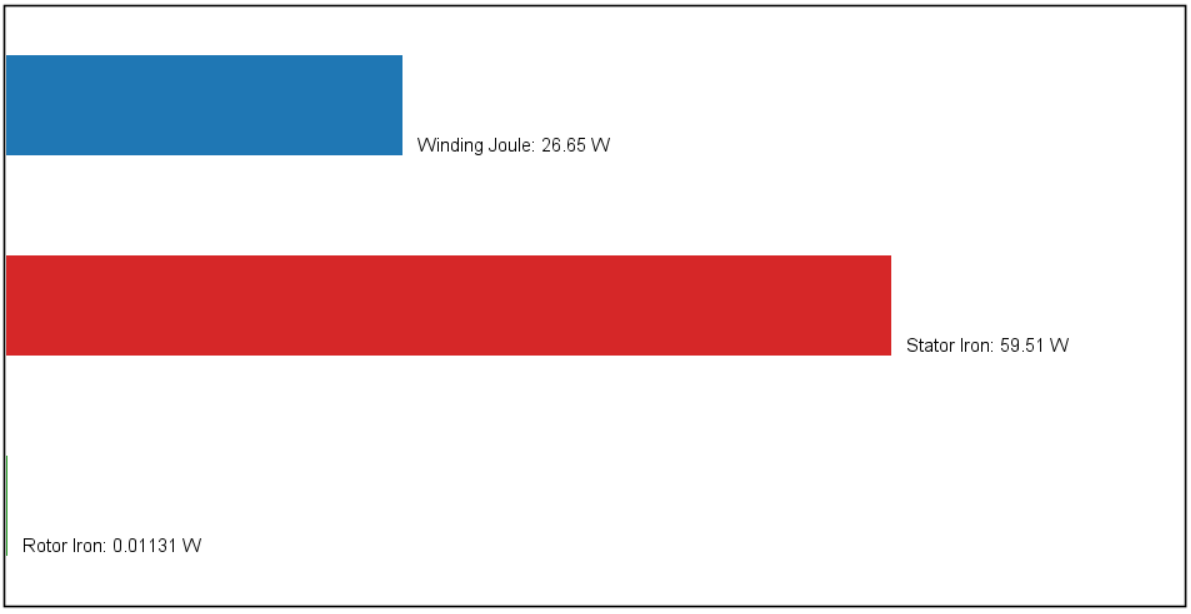


Full simulated range (91 samples). y-axis: N.m.

Loss Summary

Parameter	Value	Unit	Comments
Winding Joule	26.6539	W	
Stator Iron	59.5058	W	
Rotor Iron	0.0113129	W	
Total Losses	86.1710	W	
Efficiency	90.4005	%	
Power Factor	0.996769	-	

Loss Breakdown



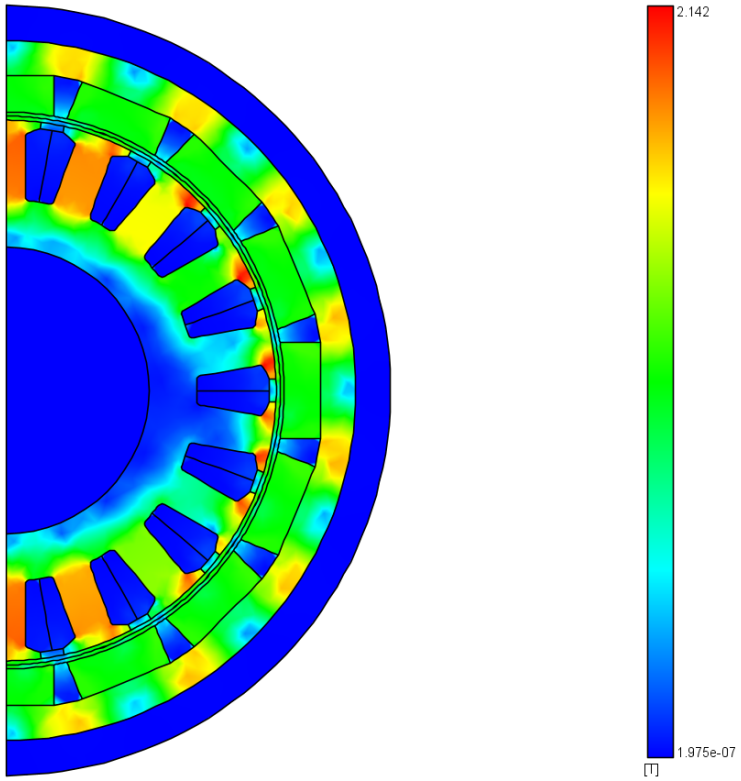
Total losses: 86.171 W

Performance Analysis

No performance-analysis items produced a result for this run.

Field Images

Flux Density Magnitude |B|



step 91/91 | t = 0.000375000 s | rotor position = 0.00 deg