Table 1: Torque in the single-phase motor

| Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain	$\vec{T}, \Phi - \Phi$ Time domain
0	0	5.468e-9	1.681e-5	1.566e-4	1.011e-5	6.125e-6
39.79351	0.052766	0.04422	0.04428	0.04434	0.0436	0.0436
79.58701	0.096143	0.08571	0.85808	0.08584	0.0851	0.0851
119.3805	0.14305	0.12569	0.12673	0.12677	0.1246	0.1245
159.174	0.19957	0.17555	0.17574	0.17575	0.1738	0.1738
198.9675	0.2754	0.24126	0.24149	0.24146	0.2363	0.2362
238.761	0.367972	0.31915	0.32021	0.32015	0.3135	0.3134
278.5546	0.442137	0.37683	0.37713	0.37702	0.3645	0.3633
318.3481	0.375496	0.30146	0.30182	0.30166	0.2857	0.2855
358.1416	-0.0707	-0.10068	-0.10024	-0.10046	-0.1113	-0.1115
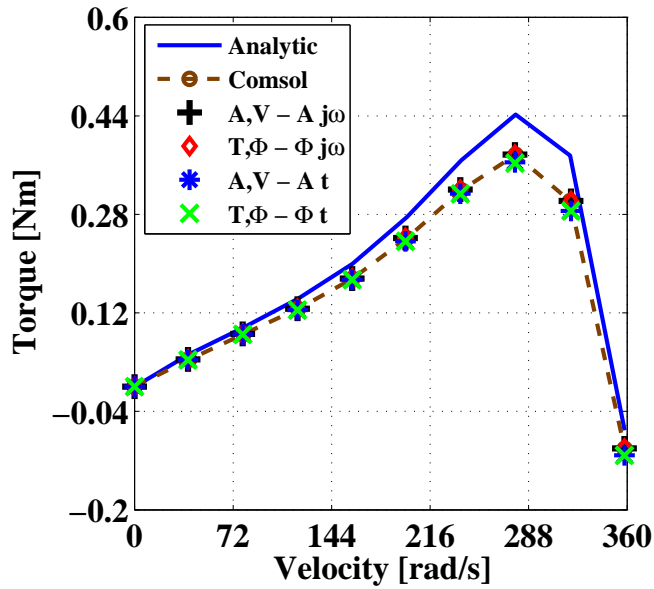
Figure 1: Torque-speed characteristics of the single-phase motors.

Table 2: Rotor loss in the single-phase motor

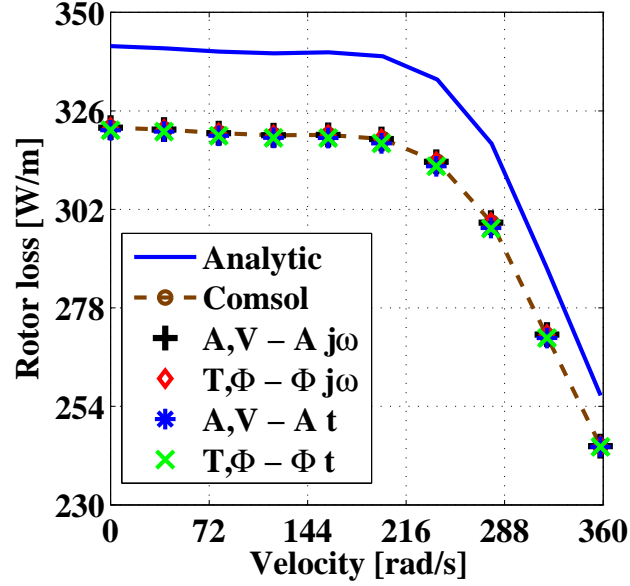|	ROTOR LOSS [W/m]					
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain	$\vec{T}, \Phi - \Phi$ Time domain
0	341.7676	321.8952	321.8952	321.8952	321.2812	321.2811
39.79351	341.2465	321.461	321.4612	321.4609	320.9589	320.9588
79.58701	340.4618	320.5624	320.5624	320.5623	319.9352	319.9531
119.3805	340.0396	320.0629	320.063	320.0625	319.4121	319.4118
159.174	340.225	320.1429	320.1429	320.1423	319.3881	319.3877
198.9675	339.2994	319.1407	319.1407	319.1406	318.0969	318.0964
238.761	333.6163	313.5793	313.5792	313.5784	312.5161	312.5154
278.5546	317.9933	298.7739	298.774	298.7728	297.4517	297.3147
318.3481	288.079	271.4886	271.4886	271.4873	270.6503	270.6492
358.1416	256.6437	244.3109	244.311	244.3093	244.1438	244.1427

Figure 2: The power dissipation of rotor of the single-phase motors.

Table 3: Steel loss in the single-phase motor

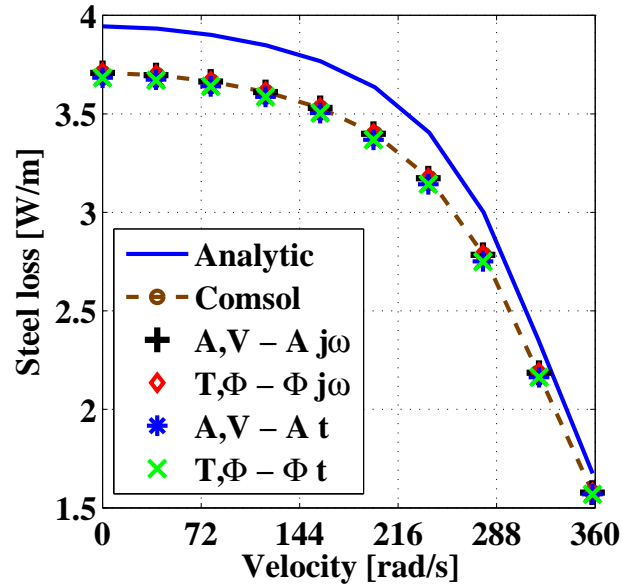| STEEL LOSS [W/m]						
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain	$\vec{T}, \Phi - \Phi$ Time domain
0	3.944175	3.707725	3.707716	3.707715	3.683761	3.683762
39.79351	3.933111	3.696603	3.696601	3.696603	3.674073	3.674071
79.58701	3.900878	3.664197	3.664213	3.664209	3.639751	3.639753
119.3805	3.848117	3.611196	3.611191	3.611203	3.586207	3.586204
159.174	3.767681	3.530708	3.530713	3.53071	3.504074	3.504077
198.9675	3.635357	3.399406	3.400102	3.399497	3.368849	3.368851
238.761	3.404092	3.172887	3.172904	3.172902	3.142321	3.142326
278.5546	2.999715	2.784787	2.784802	2.784803	2.751628	2.749486
318.3481	2.355622	2.186231	2.186245	2.186238	2.163209	2.163214
358.1416	1.674353	1.577268	1.577313	1.577316	1.568528	1.568523

Figure 3: The power dissipation of rotor steel of the single-phase motors.

Table 4: Induced voltage in the single-phase motor

INDUCED VOLTAGE [V/m/turn]				
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain
0	0.536071	0.521899	0.521902	0.5187
39.79351	0.537466	0.523172	0.523201	0.5201
79.58701	0.541495	0.527026	0.527032	0.5239
119.3805	0.548603	0.533771	0.533784	0.5307
159.174	0.650074	0.544594	0.544612	0.5416
198.9675	0.578808	0.562153	0.562152	0.5587
238.761	0.609649	0.590768	0.590797	0.5853
278.5546	0.658967	0.635713	0.635708	0.6245
318.3481	0.728552	0.697472	0.697494	0.6728
358.1416	0.790068	0.750178	0.750188	0.7091
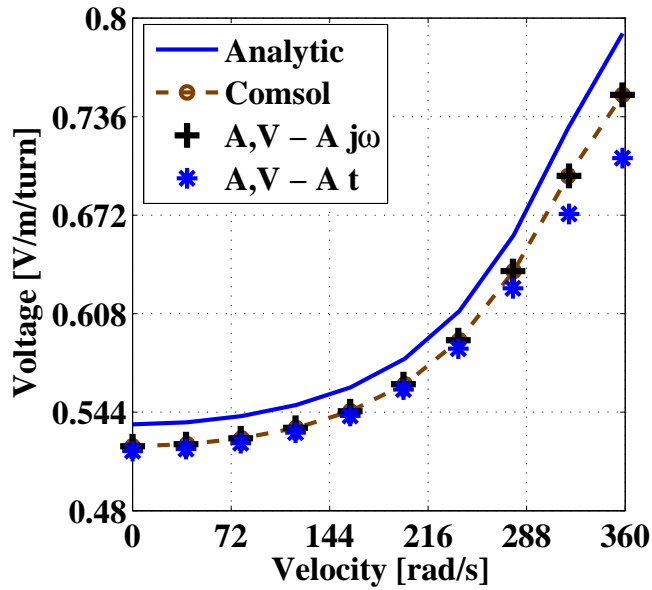
Figure 4: The induced voltage of the single-phase motor.

Table 5: Torque in the three-phase motor

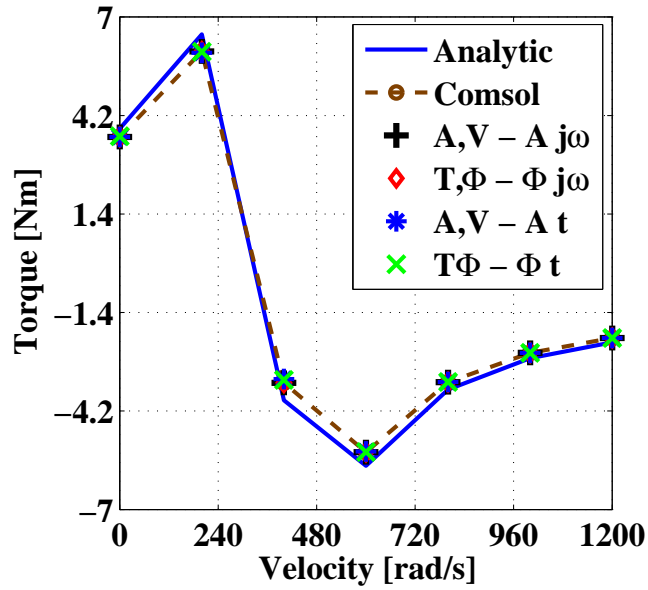|			TORQUE [Nm]			
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain	$\vec{T}, \Phi - \Phi$ Time domain
0	3.825857	3.59153	3.5912	3.5919	3.5884	3.6113
200	6.505013	6.02069	6.0209	6.0215	5.9835	6.0117
400	-3.89264	-3.39807	-3.3979	-3.3976	-3.2941	-3.3138
600	-5.75939	-5.63975	-5.3697	-5.3694	-5.3482	-5.3676
800	-3.59076	-3.37833	-3.3778	-3.3779	-3.3763	-3.3771
1000	-2.70051	-2.54736	-2.5465	-2.5469	-2.5472	-2.5469
1200	-2.24996	-2.12514	-2.1241	-2.1247	-2.1249	-2.1251

Figure 5: Torque-speed characteristics of the three-phase motors.

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Table 6: Rotor loss in the three-phase motor

	ROTOR LOSS [W/m]					
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain	$\vec{T}, \Phi - \Phi$ Time domain
0	1455.644	1366.922	1366.922	1366.921	1366.104	1366.002
200	1179.541	1093.952	1093.952	1093.951	1087.317	1087.552
400	120.0092	108.5928	108.5922	108.5903	106.5816	107.0713
600	1314.613	1227.914	1227.912	1227.905	1223.403	1223.706
800	1548.24	1458.668	1458.666	1458.654	1458.401	1458.529
1000	1710.686	1615.641	1615.636	1615.621	1616.509	1616.233
1200	1878.926	1776.372	1776.637	1776.623	1778.113	1777.846

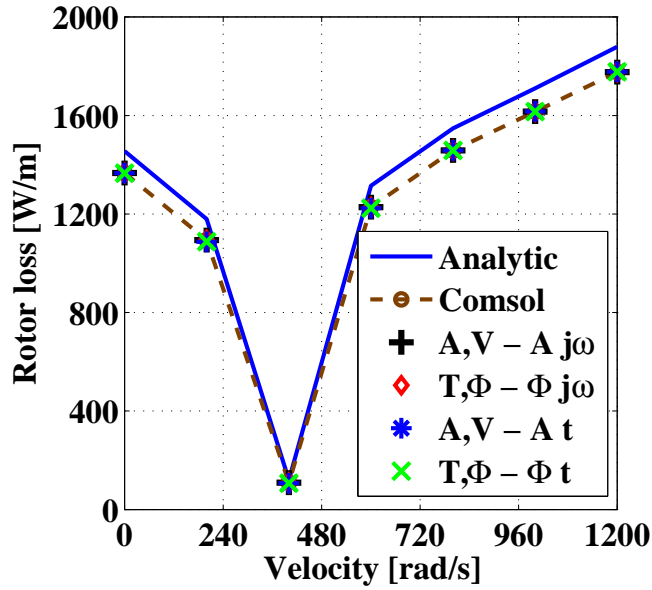Figure 6: The power dissipation of rotor of the three-phase motors.

Table 7: Steel loss in the three-phase motor

			STEEL LOSS			
			[W/m]			
Angular	Analytical	COMSOL	$\vec{A},V-\vec{A}$	$\vec{T},\Phi-\Phi$	$\vec{A},V-\vec{A}$	$\vec{T},\Phi-\Phi$
Velocity	Solution	Multiphysics	Frequency	Frequency	Time	Time
[rad/s]			domain	domain	domain	domain
0	17.40541	16.34462	16.34461	16.34462	16.25782	16.25661
200	16.98615	15.7367	15.7367	15.73672	15.55293	15.55238
400	1.383889	1.20661	1.20662	1.206611	1.167651	1.163473
600	17.87566	16.65631	16.6563	16.65631	16.50407	16.50374
800	16.88702	15.87404	15.87402	15.87404	15.79943	15.82615
1000	14.32059	13.49334	13.49335	13.49335	13.45032	13.45703
1200	12.01166	11.33068	11.3307	11.33066	11.30354	11.31948

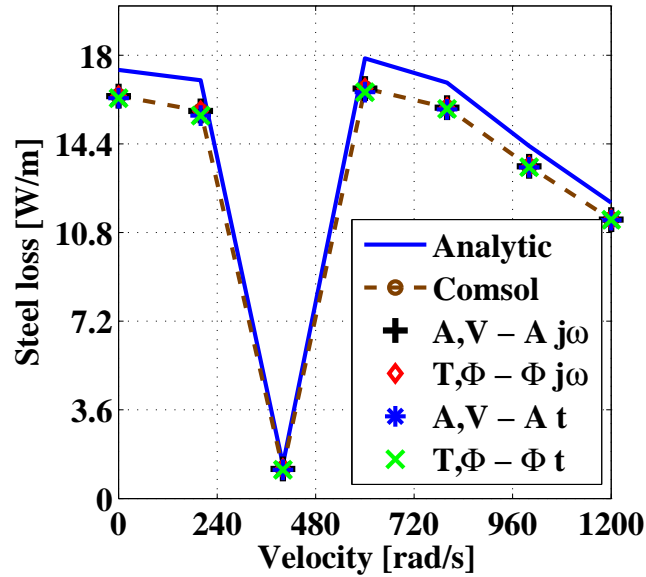Figure 7: The power dissipation of rotor steel of the three-phase motors.

Table 8: Induced voltage in the three-phase motor

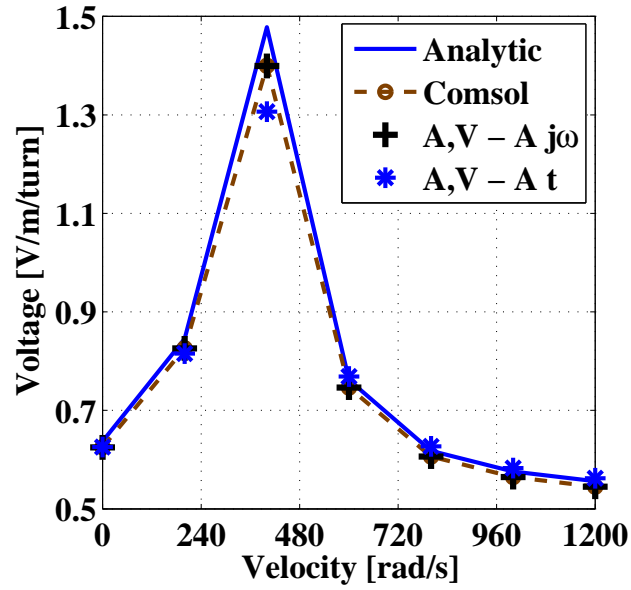| INDUCED VOLATGE | | | | |
| [V/m/turn] | | | | |
Angular Velocity [rad/s]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{A}, V - \vec{A}$ Time domain
0	0.637157	0.625034	0.625058	0.6255
200	0.845368	0.825837	0.825844	0.8154
400	1.477981	1.399524	1.399531	1.3064
600	0.76176	0.746331	0.746335	0.7686
800	0.617891	0.606367	0.606386	0.6271
1000	0.575699	0.564498	0.564507	0.5829
1200	0.556196	0.545063	0.545083	0.5623

Figure 8: The induced voltage of the three-phase motor.

Table 9: Real Part of the Radial B field for the three-phase motor

| x	$\Re\{B_r\}$ [T]			
	Analytical	COMSOL	$\vec{A}, V - \vec{A}$	$\vec{T}, \Phi - \Phi$
[m]	Solution	Multiphysics	Frequency	Frequency
			domain	domain
0.032	0.018854	0.01774	0.01777	0.01781
0.034222	0.017122	0.01612	0.01614	0.01616
0.036444	0.015643	0.01463	0.01468	0.01463
0.038667	0.014375	0.01341	0.01344	0.01338
0.040889	0.013284	0.01232	0.01235	0.01233
0.043111	0.012341	0.01143	0.01143	0.01141
0.045333	0.011522	0.01089	0.01063	0.01061
0.047556	0.010807	0.00997	0.00992	0.00991
0.049778	0.010179	0.00931	0.00929	0.00929
0.052	0.009625	0.00876	0.00876	0.00875
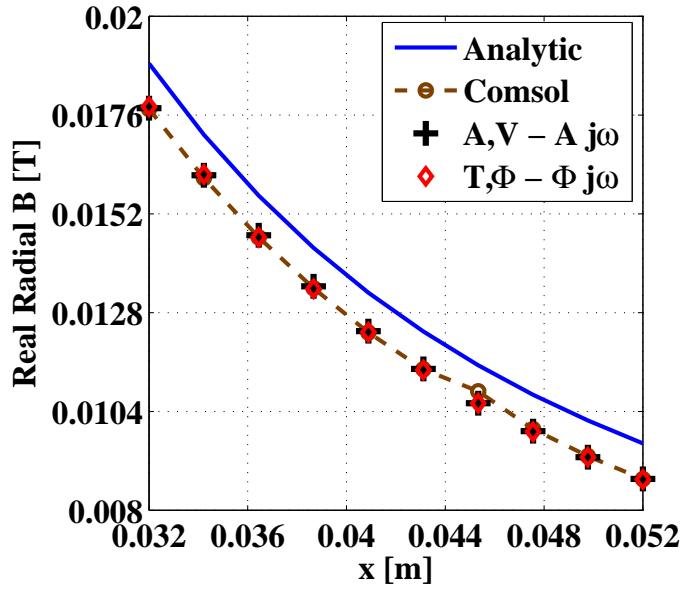
Figure 9: The real part of radial magnetic flux density.

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Table 10: Imaginary Part of the Radial B field for the three-phase motor

| | $\Im\{B_r\}$ | | | |
	[T]			
x	Analytical	COMSOL	$\vec{A}, V - \vec{A}$	$\vec{T}, \Phi - \Phi$
[m]	Solution	Multiphysics	Frequency	Frequency
			domain	domain
0.032	0.016392	0.01596	0.01596	0.01598
0.034222	0.017079	0.01654	0.01654	0.01654
0.036444	0.017412	0.01665	0.01665	0.01678
0.038667	0.017455	0.01676	0.01676	0.01675
0.040889	0.017266	0.01655	0.01655	0.01651
0.043111	0.016895	0.01611	0.01611	0.01609
0.045333	0.016385	0.01527	0.01527	0.01553
0.047556	0.015772	0.01488	0.01488	0.11488
0.049778	0.015085	0.01416	0.01416	0.01416
0.052	0.014347	0.01342	0.01343	0.01343
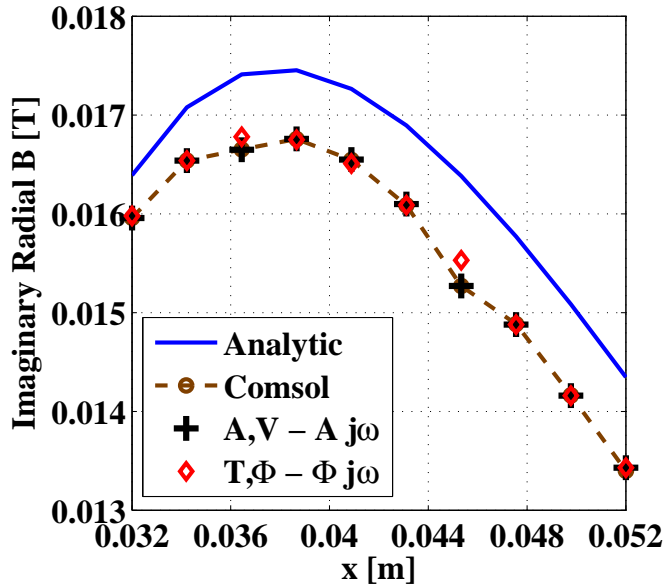
Figure 10: The imaginary part of radial magnetic flux density.

Table 11: Real Part of the Azimuthal H field for the three-phase motor

| | $\Re\{H_\theta\}$ | | | |
	[T]			
x	Analytical	COMSOL	$\vec{A}, V-\vec{A}$	$\vec{T}, \Phi-\Phi$
[m]	Solution	Multiphysics	Frequency	Frequency
			domain	domain
0.032	-46504.9	-45042.7	-44778.4	-44794.7
0.034222	-39165.7	-37526.1	-37523.3	-37526.9
0.036444	-32564.6	-30997.4	-30944.6	-31015.2
0.038667	-26449.5	-24985.6	-24983.9	-24987.4
0.040889	-20817.4	-19353.5	-19352.4	-19351.1
0.043111	-15405.7	-13979.5	-13980.8	-13976.1
0.045333	-10181.6	-8789.34	-8789.38	-8788.15
0.047556	-5084.64	-3718.38	-3717.22	-3720.01
0.049778	-71.2009	1271.767	1271.575	1271.508
0.052	4888.668	6212.994	6213.853	6215.281
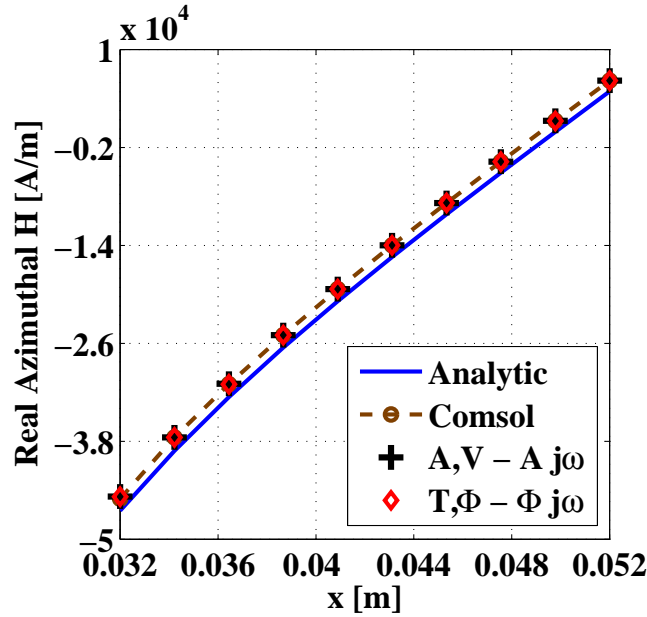
Figure 11: The real part of θ-directed magnetic field intesnity.

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Table 12: Imaginary Part of the Azimuthal H field for the three-phase motor

|	$\Im\{H_\theta\}$ [T]			
x [m]	Analytical Solution	COMSOL Multiphysics	$\vec{A}, V - \vec{A}$ Frequency domain	$\vec{T}, \Phi - \Phi$ Frequency domain
0.032	-10757.6	-11101.6	-11096.6	-11107.5
0.034222	-8939.18	-9296.83	-9293.24	-9310.26
0.036444	-7462.55	-7846.27	-7847.01	-7848.92
0.038667	-6253.55	-6660.39	-6660.59	-6667.57
0.040889	-5250.13	-5677.03	-5679.32	-5677.96
0.043111	-4406.77	-4850.71	-4851.54	-4850.75
0.045333	-3690.02	-4148.36	-4149.02	-4147.22
0.047556	-3074.86	-3545.74	-3546.24	-3543.66
0.049778	-2542.22	-3024.09	-3024.16	-3023.87
0.052	-2077.37	-2568.85	-2568.87	-2567.37
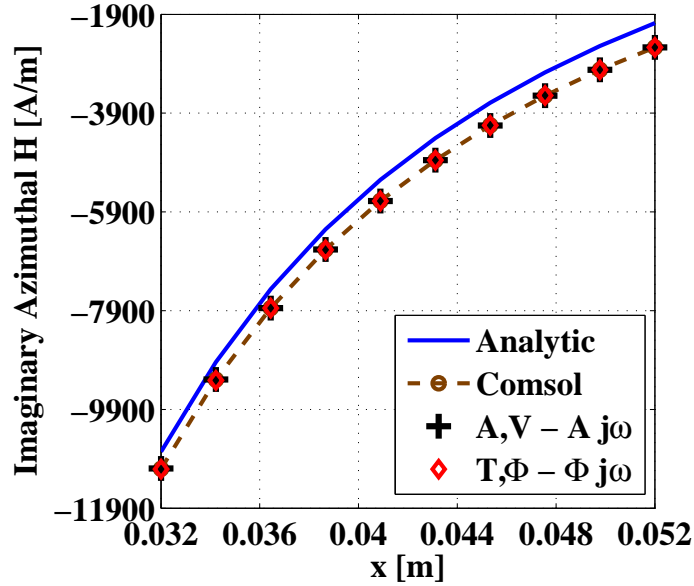
Figure 12: The imaginary part of θ-directed magnetic field intesnity.