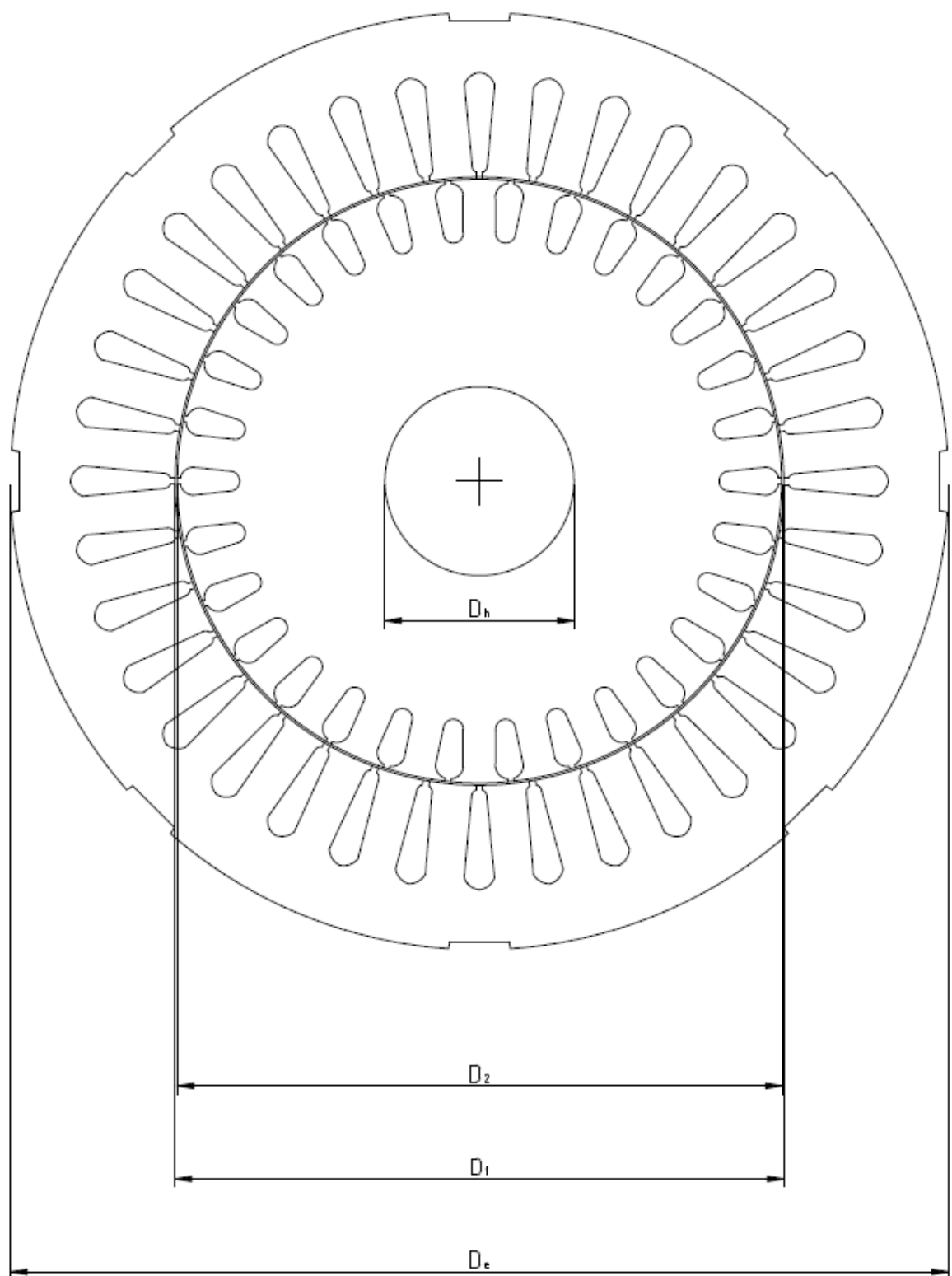
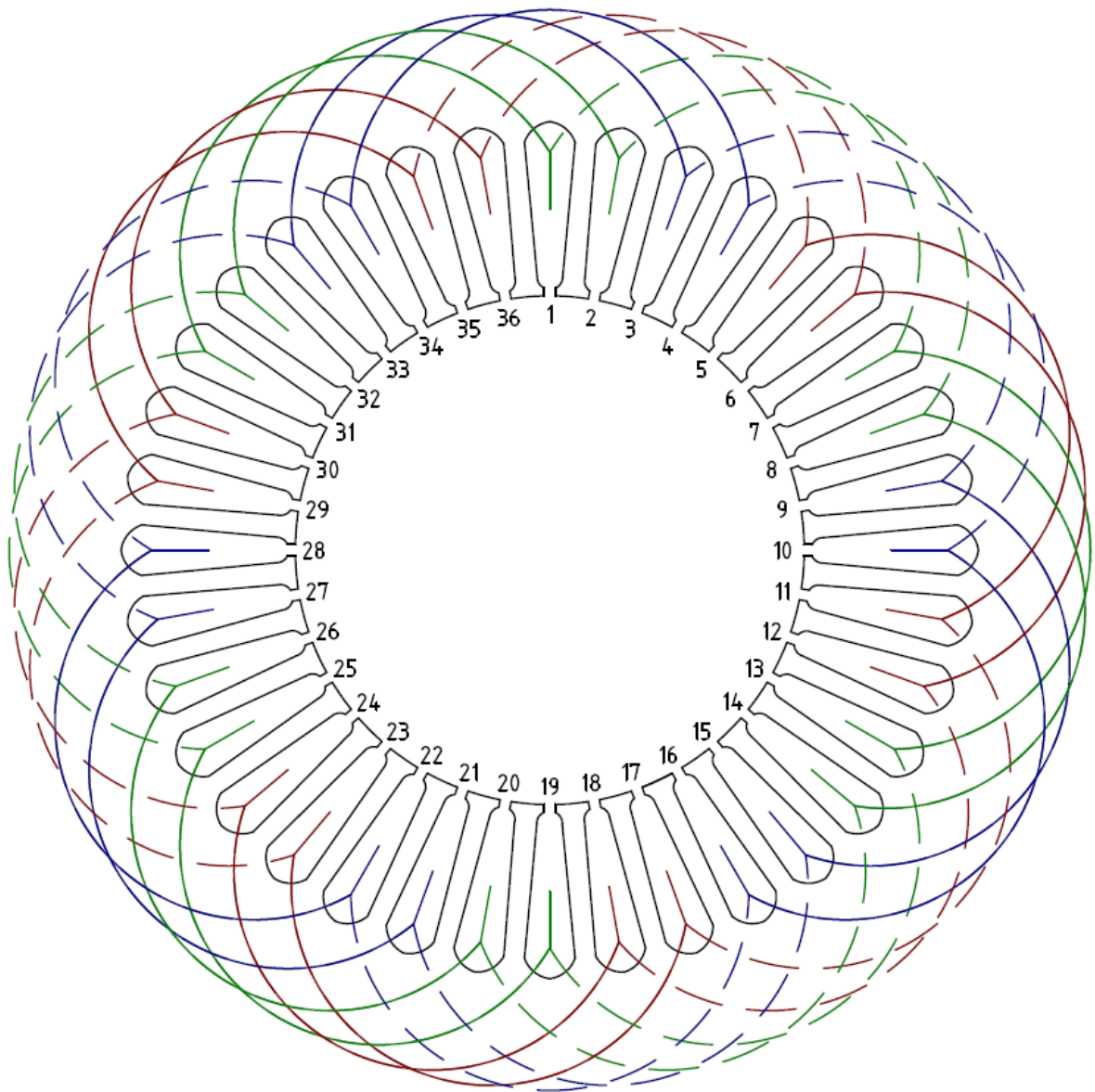


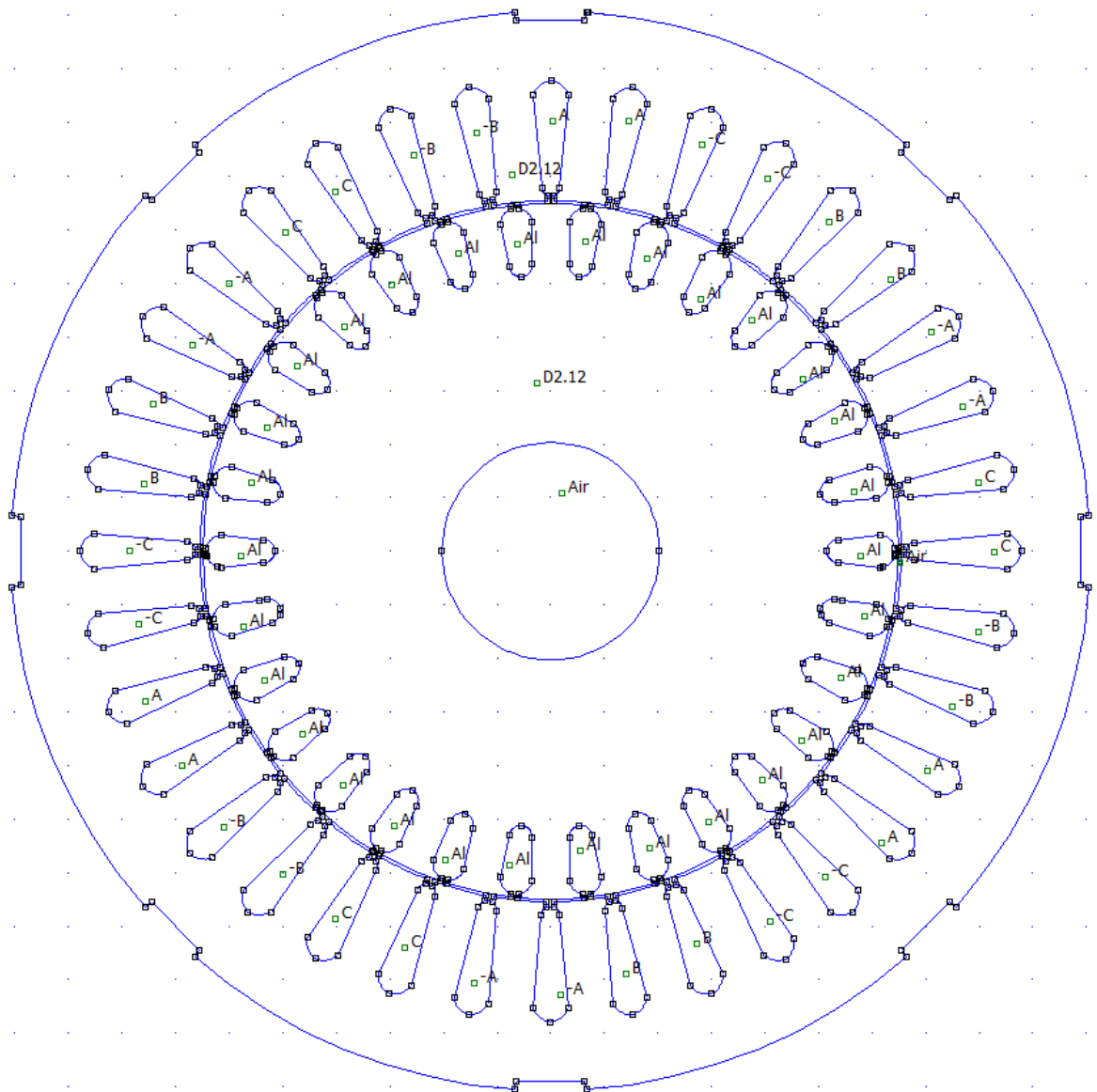
Obrázek A.1: Model původního (analyzovaného) asynchronního motoru



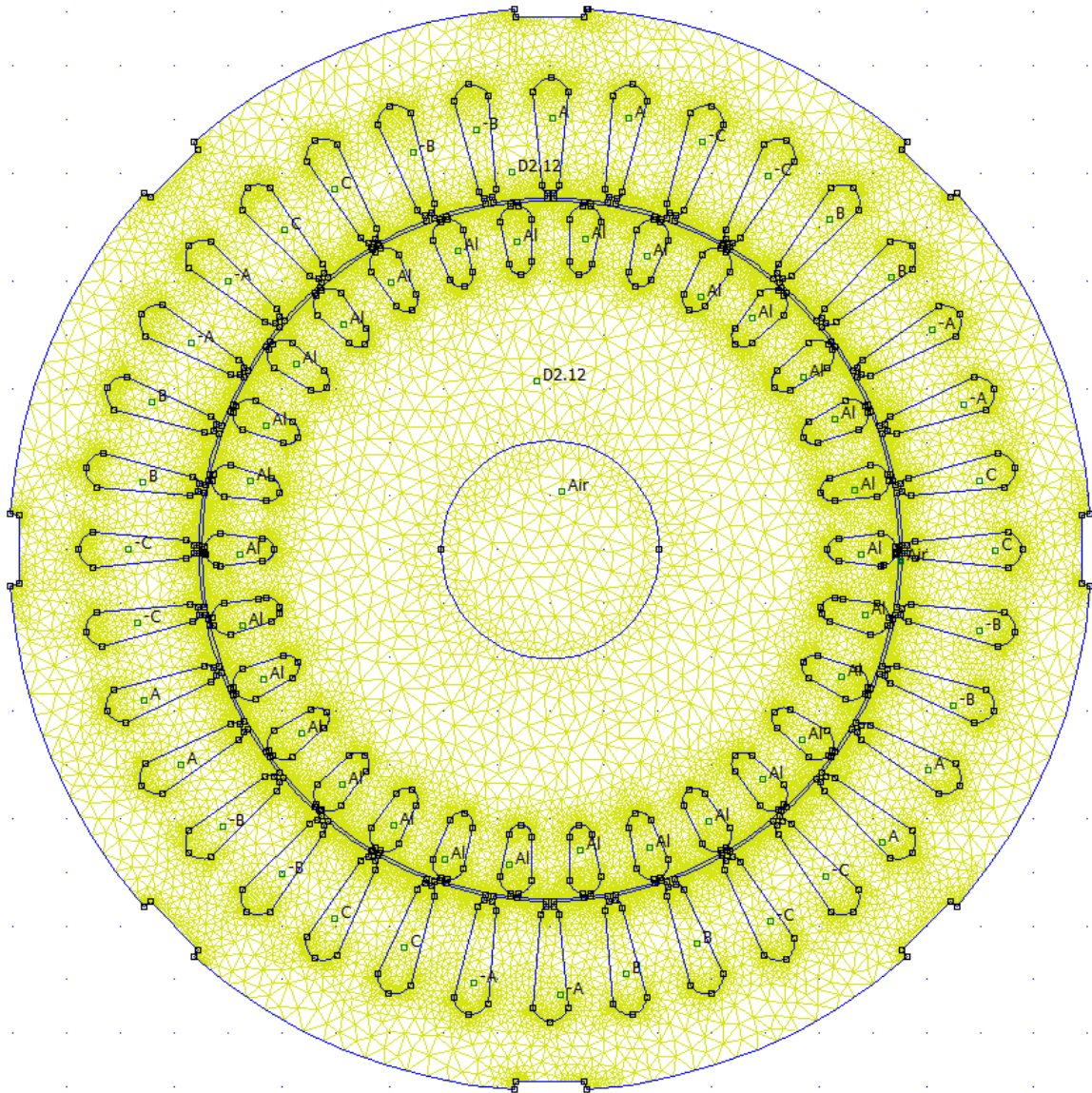
Obrázek A.2: Řez původním motorem s vyznačenými průměry



Obrázek A.3: Přehled fází vinutí původního (analyzovaného) motoru

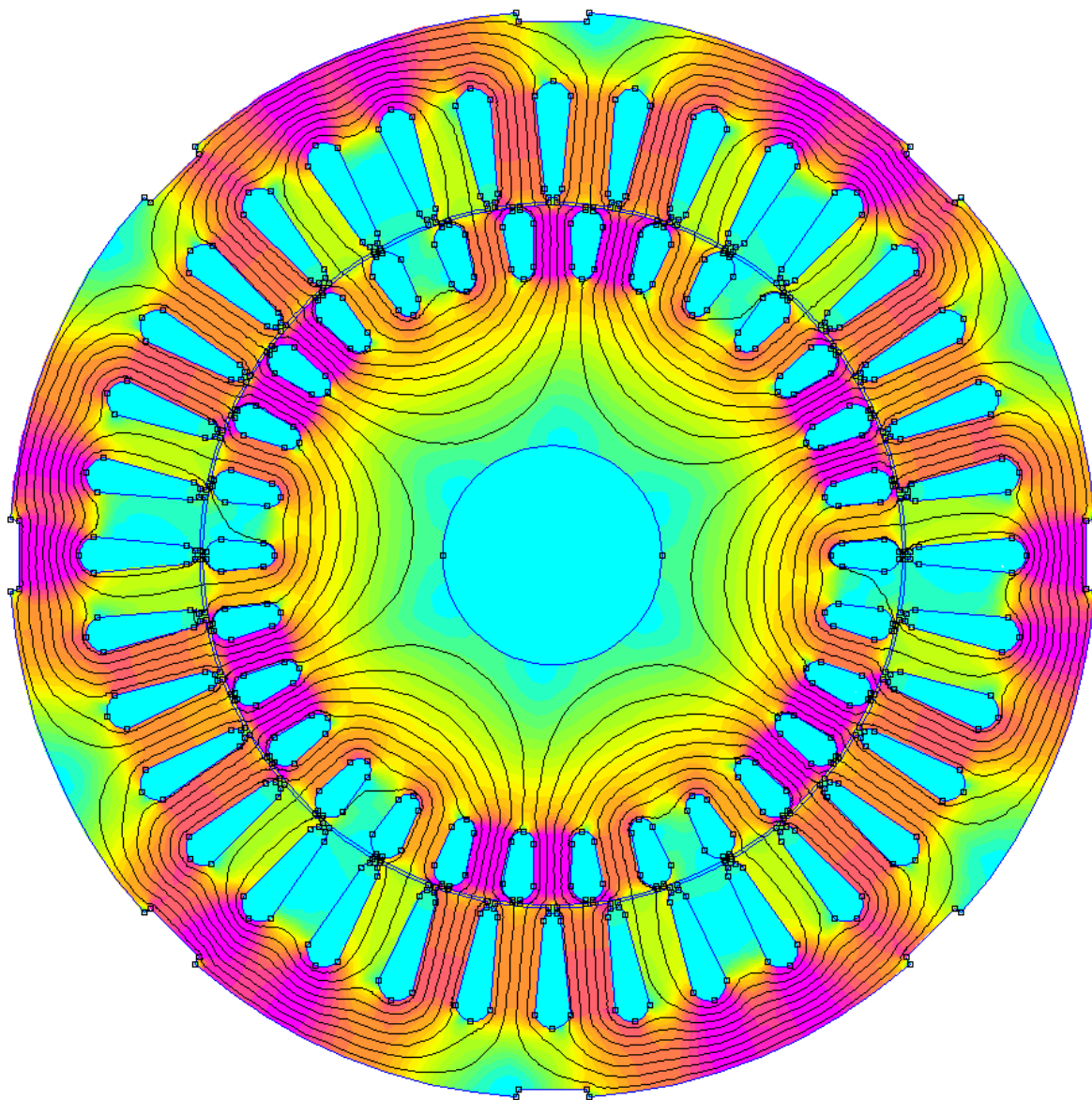


Obrázek A.4: Model analyzovaného motoru v prostředí FEMM

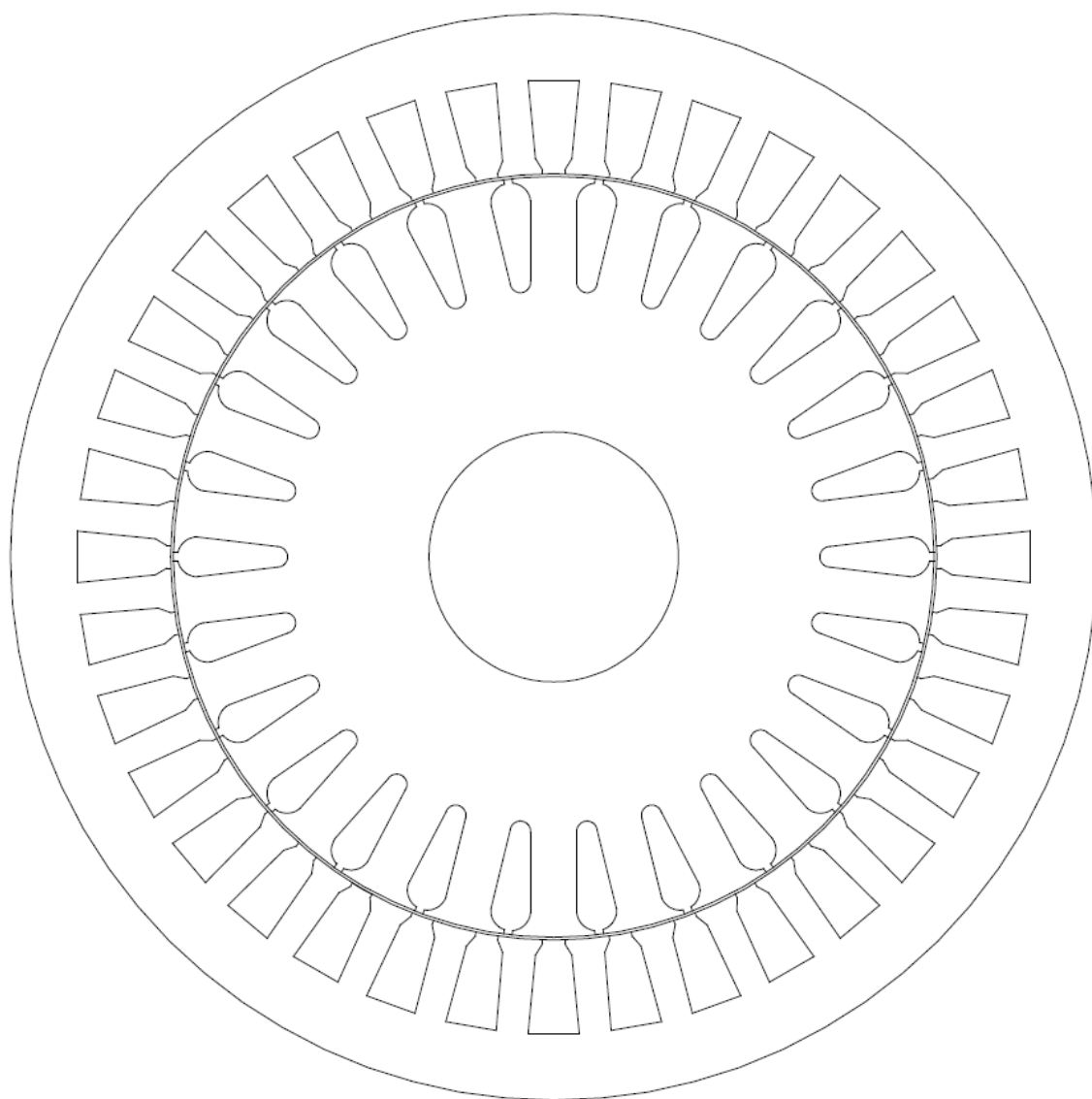


Obrázek A.5: Vytvořená síť na analyzovaném motoru

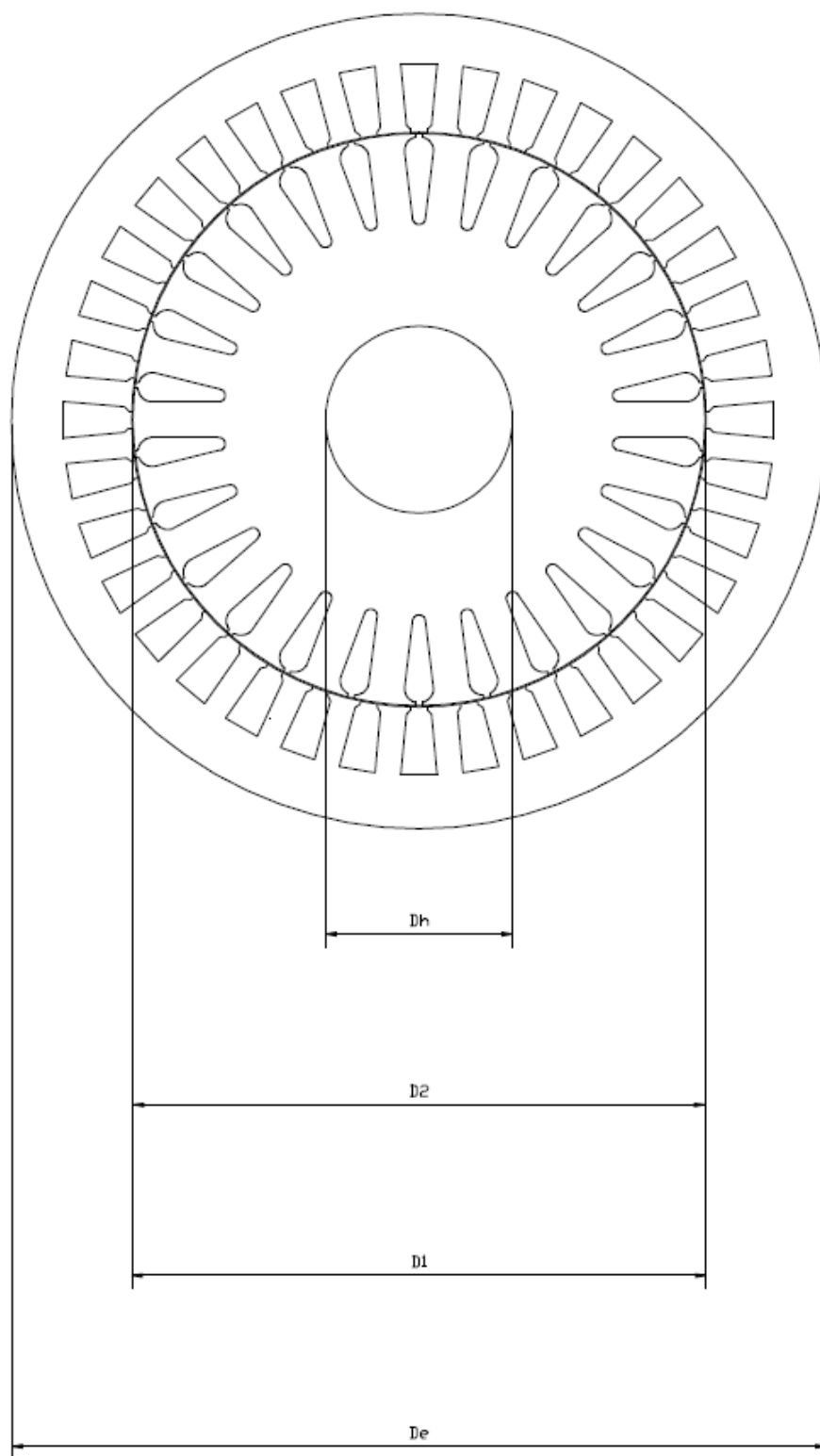




Obrázek A.6: Rozložení magnetické indukce v asynchronním motoru

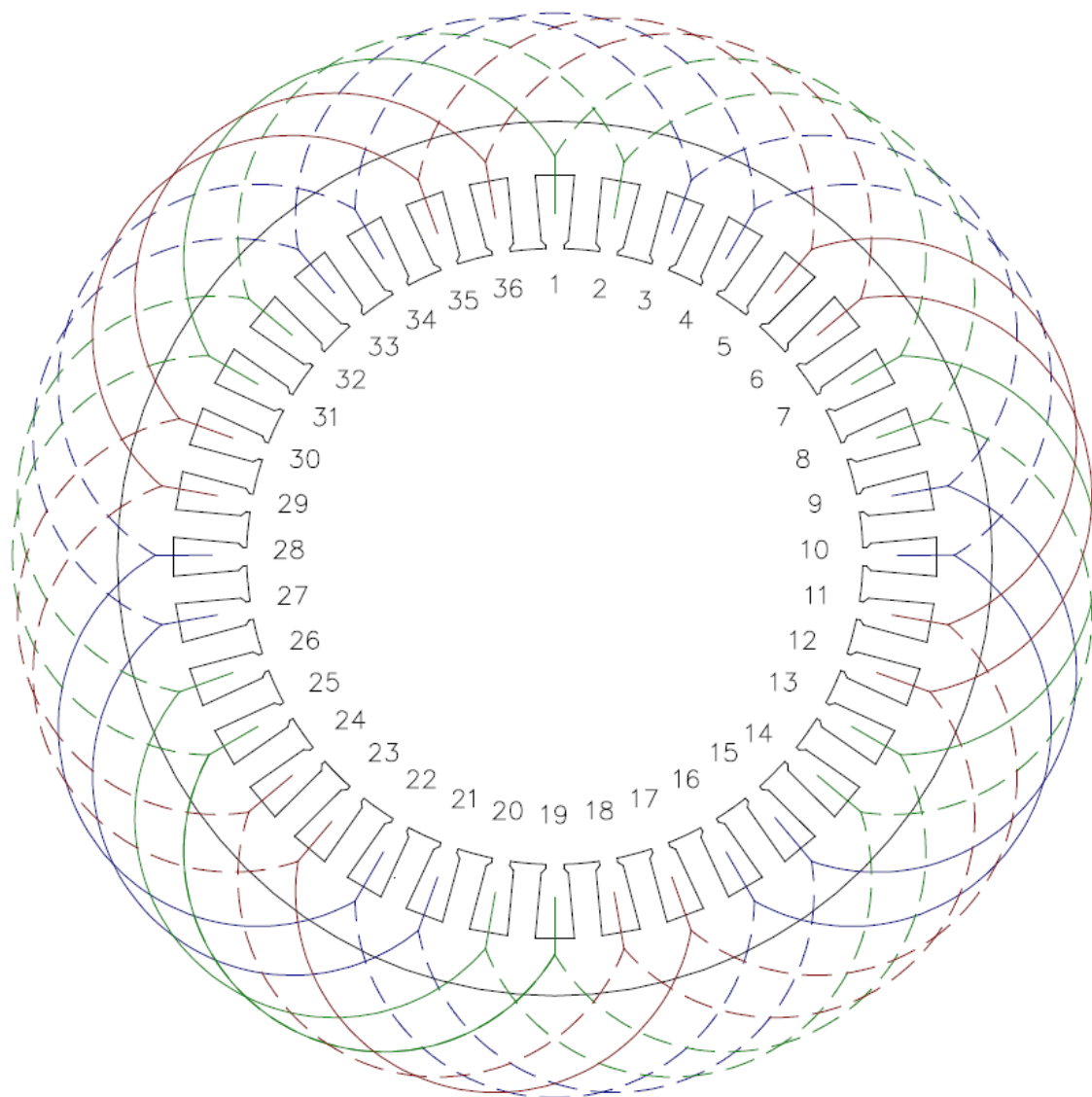


**Obrázek A.7:** Model navrženého asynchronního motoru

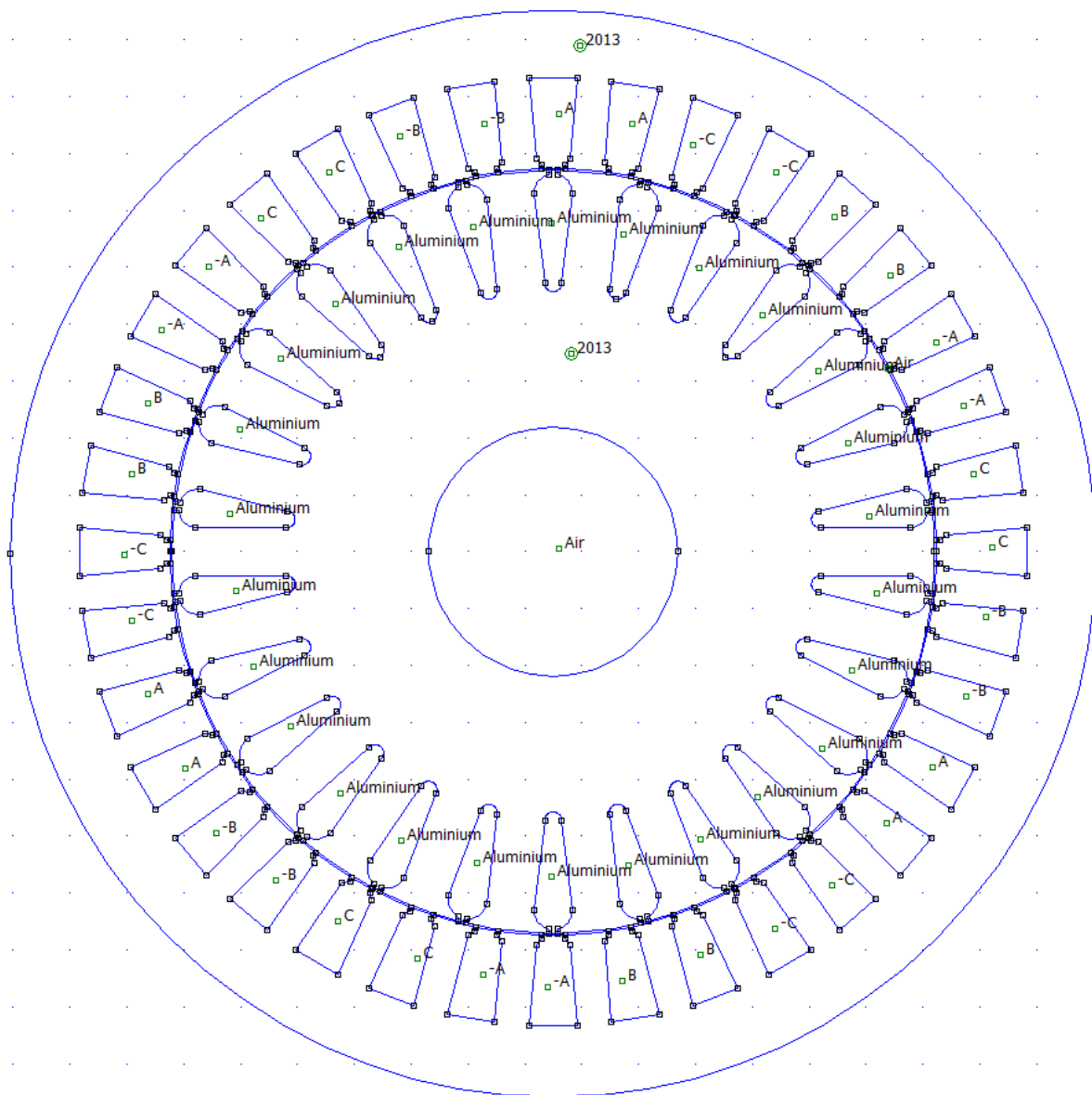


**Obrázek A.8:** Výšek navrženého motoru s vyznačenými průměry

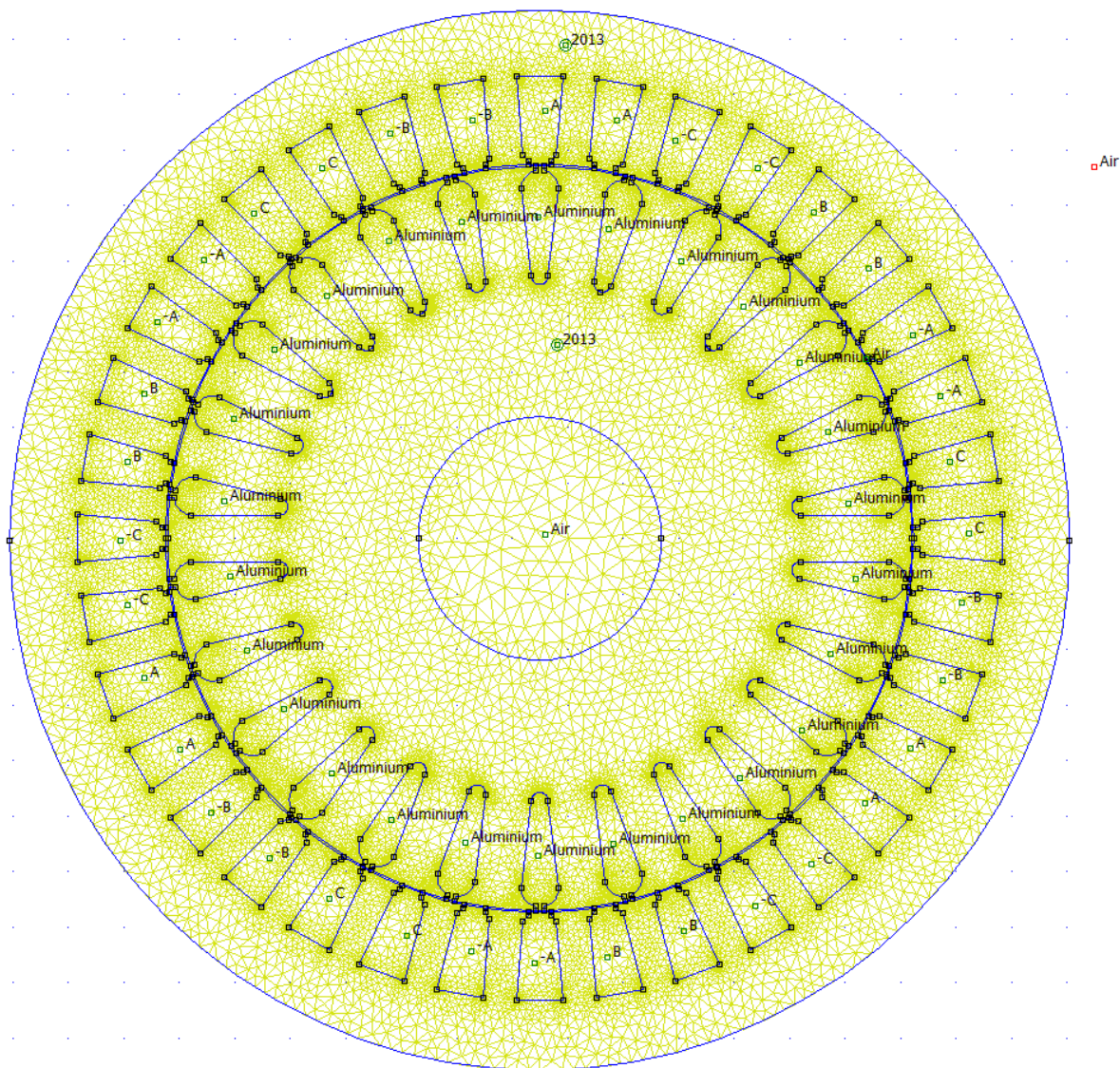




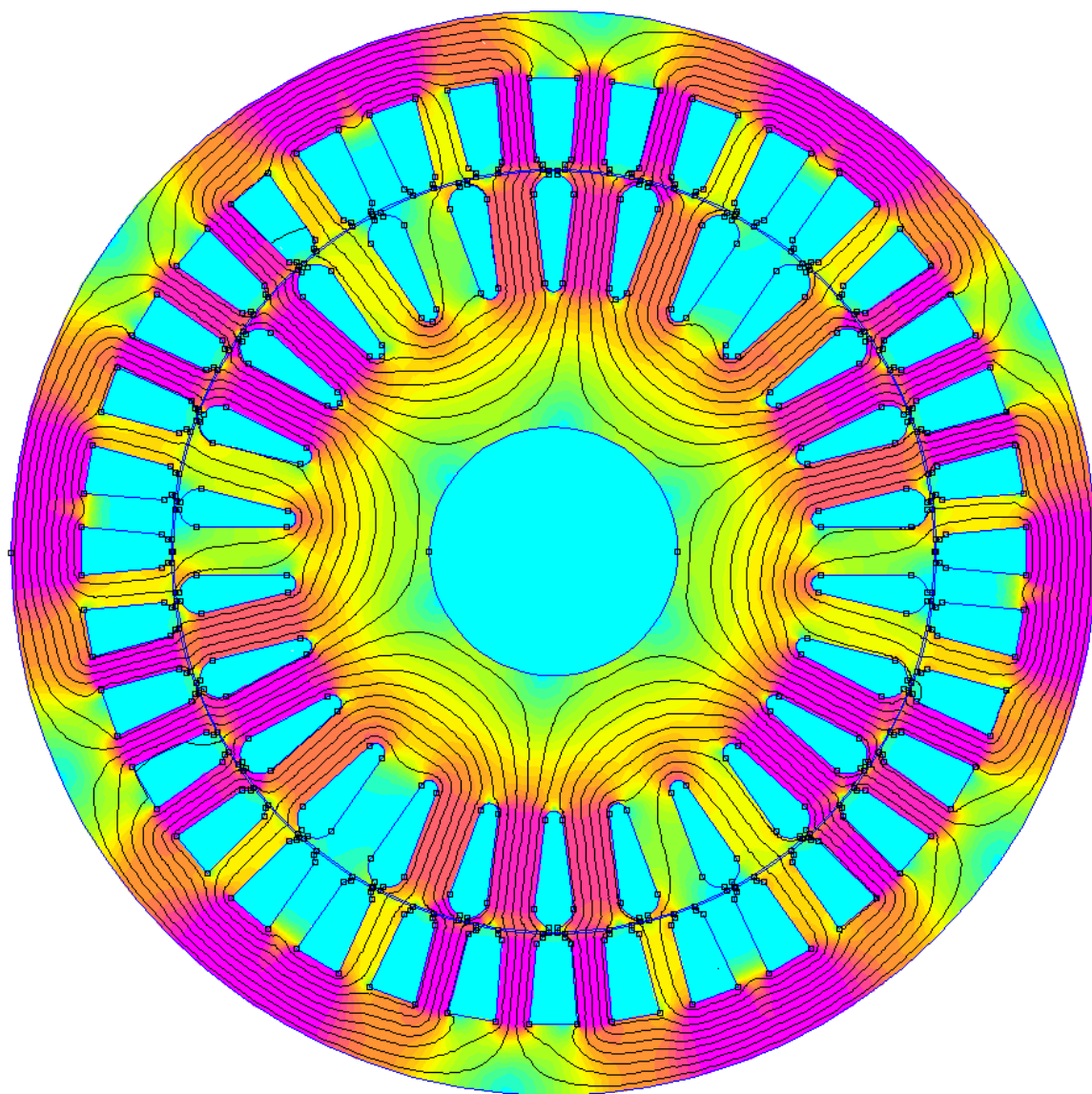
**Obrázek A.9:** Přehled fází vinutí navrženého motoru



Obrázek A.10: Model analyzovaného navrženého motoru v prostředí FEMM



Obrázek A.11: Vytvořená síť na navrženém analyzovaném motoru



Obrázek A.12: Rozložení magnetické indukce v nově navrženém motoru



**Non-oriented fully processed electrical steel  
M210-35A**

**Typical values**

POLARISATION J <sub>peak</sub> T	SPECIFIC TOTAL LOSS									
	at 50 Hz		at 60 Hz		at 400 Hz		at 700 Hz		at 1000 Hz	
	W/kg	W/lb	W/kg	W/lb	W/kg	W/lb	W/kg	W/lb	W/kg	W/lb
0.1	0.02	0.01	0.03	0.01	0.19	0.09	0.52	0.24	0.96	0.44
0.2	0.05	0.02	0.06	0.03	0.87	0.39	1.99	0.90	3.59	1.63
0.3	0.10	0.05	0.12	0.05	1.85	0.84	4.23	1.92	7.53	3.42
0.4	0.19	0.09	0.23	0.10	3.09	1.40	7.11	3.23	12.5	5.67
0.5	0.27	0.12	0.33	0.15	4.58	2.08	10.6	4.81	18.8	8.53
0.6	0.36	0.16	0.45	0.20	6.33	2.87	14.8	6.71	26.3	11.9
0.7	0.46	0.21	0.58	0.26	8.35	3.79	19.7	8.94	35.3	16.0
0.8	0.57	0.26	0.72	0.33	10.6	4.81	25.4	11.5	45.8	20.8
0.9	0.69	0.31	0.87	0.39	13.2	5.99	32.0	14.5	58.0	26.3
1.0	0.83	0.38	1.05	0.48	16.2	7.35	39.6	18.0	72.1	32.7
1.1	0.98	0.44	1.24	0.56	19.5	8.85	48.3	21.9	88.5	40.1
1.2	1.16	0.53	1.46	0.66	23.3	10.6	58.3	26.4	107	48.5
1.3	1.40	0.64	1.76	0.80	27.8	12.6	70.1	31.8	129	58.5
1.4	1.70	0.77	2.14	0.97	33.6	15.2	85.1	38.6		
1.5	2.00	0.91	2.52	1.14	41.0	18.6	105	47.6		
1.6	2.26	1.03	2.86	1.30	50.3	22.8				
1.7	2.46	1.12	3.12	1.42						
1.8	2.66	1.21	3.37	1.53						

	GUARANTEED VALUES		TYPICAL VALUES	
Loss at 1.0 T & 50 Hz	-	-	0.83 W/kg	0.38 W/lb
Loss at 1.0 T & 60 Hz	-	-	1.05 W/kg	0.48 W/lb
Loss at 1.5 T & 50 Hz	2.10 W/kg	0.95 W/lb	2.00 W/kg	0.91 W/lb
Loss at 1.5 T & 60 Hz	2.65 W/kg	1.20 W/lb	2.52 W/kg	1.14 W/lb
Loss at 1.5 T & 50 Hz in rolling direction	-	-	1.78 W/kg	0.81 W/lb
Loss at 1.5 T & 60 Hz in rolling direction	-	-	2.24 W/kg	1.02 W/lb
Anisotropy of loss	± 17 %		+ 12 %	
Magnetic polarisation at 2500 A/m & 50 Hz	1.49 T		1.55 T	
Magnetic polarisation at 5000 A/m & 50 Hz	1.60 T		1.65 T	
Magnetic polarisation at 10000 A/m & 50 Hz	1.70 T		1.77 T	
Relative permeability at 1.5 T & 50 Hz	-		820	
Relative permeability at 1.6 T & 50 Hz	-		365	
Nominal thickness	-	-	0.35 mm	0.0138 inch
Density (assumed)	-	-	7.60 kg/dm <sup>3</sup>	0.275 lb/inch <sup>3</sup>
Resistivity	-		59 µΩcm	
Yield strength	-	-	445 MPa	64 500 psi
Tensile strength	-	-	550 MPa	79 800 psi
Young's modulus, rolling direction	-	-	185 000 MPa	2.68·10 <sup>7</sup> psi
Young's modulus, transverse direction	-	-	200 000 MPa	2.90·10 <sup>7</sup> psi
Hardness HV5	-		210	

Values for the yield strength (0.2% proof strength) and tensile strength are given for the rolling direction. Corresponding values for the transverse direction are approximately 5 % higher.

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**Obrázek A.13:** Datasheet magnetické oceli s nižším ztrátovým číslem

	M210-35A	M235-35A	M250-35A	M270-35A	M330-35HS	M330-35HT	M330-35HP	M250-50A	M270-50A	M290-50A	M310-50A	M330-50A	M350-50A	M400-50A	M470-50A
$B_{z1}$ [T]	9505,97	10101,40	9784,02	9670,99	9301,47	7822,72	9323,81	9553,68	9371,06	9358,03	8723,20	8781,68	8750,15	8922,32	6117,70
$H_{z1}$ [T]	9505,97	10101,40	9784,02	9670,99	9301,47	7822,72	9323,81	9553,68	9371,06	9358,03	8723,20	8781,68	8750,15	8922,32	6117,70
$B_{z2}$ [A/m]	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71
$H_{z2}$ [A/m]	7112,86	8030,53	7694,20	7566,95	7121,61	5800,18	7101,77	7321,69	7158,03	7130,78	6567,03	6549,69	6601,56	6776,10	4312,20
$B_{j1}$ [T]	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65
$H_{j1}$ [A/m]	5047,64	6017,62	5657,59	5517,58	5092,63	3990,41	5005,54	5282,63	5142,66	5107,65	4607,72	4519,14	4603,16	4768,15	2785,76
$B_{j2}$ [T]	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84
$H_{j2}$ [A/m]	65,46	73,50	83,10	88,65	86,25	92,35	80,70	94,60	95,87	95,76	93,59	74,89	99,81	91,01	118,48
$U_{\delta}$ [A]	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28
$U_{z1}$ [A]	318,45	338,40	327,76	323,98	311,60	262,06	312,35	320,05	313,93	313,49	292,23	294,19	293,13	298,90	204,94
$U_{z2}$ [A]	290,20	327,65	313,92	308,73	290,56	236,65	289,75	298,73	292,05	290,94	267,93	267,23	269,34	276,47	175,94
$U_{j1}$ [A]	472,56	563,37	529,66	516,55	476,77	373,58	468,62	494,56	481,45	478,18	431,37	423,08	430,95	446,39	260,80
$U_{j2}$ [A]	2,32	2,61	2,95	3,14	3,06	3,27	2,86	3,35	3,40	3,39	3,32	2,65	3,54	3,23	4,20
$F_m$ [A]	1634,81	1783,29	1725,57	1703,68	1633,27	1426,84	1624,85	1667,96	1642,11	1637,28	1546,13	1538,43	1548,24	1576,26	1197,16
$k_z$ [-]	2,10	2,21	2,16	2,15	2,09	1,90	2,09	2,12	2,10	2,10	2,02	2,02	2,02	2,04	1,69
$k_f$ [A]	2,97	3,23	3,13	3,09	2,96	2,59	2,95	3,03	2,98	2,97	2,80	2,79	2,81	2,86	2,17
$I_{mag}$ [A]	6,67	7,27	7,04	6,95	6,66	5,82	6,63	6,80	6,70	6,68	6,31	6,28	6,32	6,43	4,88
$i_{mag}$ [-]	1,02	1,11	1,08	1,06	1,02	0,89	1,02	1,04	1,03	1,02	0,97	0,96	0,97	0,98	0,75
	M530-50A	M600-50A	M700-50A	M800-50A	M1000-100A	M600-65A	2013	2211	2312	2411	Ei45-50	Ei55-50	Ei70-50	Ei130-35	11330.21
$B_{z1}$ [T]	5401,24	6637,81	6435,60	5740,28	5886,42	5914,38	1630,71	2903,89	2903,89	3761,41	3215,20	2328,65	2279,96	3043,06	2088,57
$H_{z1}$ [T]	5401,24	6637,81	6435,60	5740,28	5886,42	5914,38	1630,71	2903,89	2903,89	3761,41	3215,20	2328,65	2279,96	3043,06	2088,57
$B_{z2}$ [A/m]	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71	1,71
$H_{z2}$ [A/m]	3696,68	4737,54	4587,45	4039,04	4104,62	4129,26	1227,91	2297,32	2297,32	2955,81	2599,15	1759,99	1701,82	2370,15	1628,91
$B_{j1}$ [T]	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65
$H_{j1}$ [A/m]	2354,51	3103,13	2993,18	2593,35	2683,41	2656,34	949,70	1774,40	1774,40	2179,08	2014,31	1313,50	1240,99	1795,34	1273,61
$B_{j2}$ [T]	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84
$H_{j2}$ [A/m]	138,37	588,55	146,48	186,27	219,19	126,48	136,53	210,56	210,56	87,71	162,53	126,50	148,95	137,74	323,77
$U_{\delta}$ [A]	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28	551,28
$U_{z1}$ [A]	180,94	222,37	215,59	192,30	197,20	198,13	54,63	97,28	97,28	126,01	107,71	78,01	76,38	101,94	69,97
$U_{z2}$ [A]	150,82	193,29	187,17	164,79	167,47	168,47	50,10	93,73	93,73	120,60	106,05	71,81	69,43	96,70	66,46
$U_{j1}$ [A]	220,43	290,51	280,22	242,79	251,22	248,68	88,91	166,12	166,12	204,00	188,58	122,97	116,18	168,08	119,23
$U_{j2}$ [A]	4,90	20,86	5,19	6,60	7,77	4,48	4,84	7,46	7,46	3,11	5,76	4,48	5,28	4,88	11,48
$F_m$ [A]	1108,38	1278,31	1239,45	1157,76	1174,93	1171,05	749,76	915,87	915,87	1005,00	959,37	828,55	818,55	922,88	818,42
$k_z$ [-]	1,60	1,75	1,73	1,65	1,66	1,67	1,19	1,35	1,35	1,45	1,39	1,27	1,26	1,36	1,25
$k_f$ [A]	2,01	2,32	2,25	2,10	2,13	2,12	1,36	1,66	1,66	1,82	1,74	1,50	1,48	1,67	1,48
$I_{mag}$ [A]	4,52	5,21	5,06	4,72	4,79	4,78	3,06	3,74	3,74	4,10	3,91	3,38	3,34	3,76	3,34
$i_{mag}$ [-]	0,69	0,80	0,77	0,72	0,73	0,73	0,47	0,57	0,57	0,63	0,60	0,52	0,51	0,58	0,51

Obrázek A.14: Tabulka s vlastnostmi magnetického obvodu pro uvažované druhy plechů

	2013	2211	2312	2411	Ei45 - 50	Ei55-50	Ei70-50	Ei130-35
$\Delta p_{1,0}$ [W/kg]	2.50	2.50	1.75	1.60	2.00	2.60	3.00	1.30
$\beta$ [-]	1.50	1.50	1.40	1.30	1.50	1.50	1.50	1.50
$\Delta P_{Feh}$ [W]	65.05	65.05	49.68	46.60	54.80	67.10	75.31	40.45
$p_{\delta p_2}$ [W/m <sup>2</sup> ]	164.68	164.68	164.68	164.68	164.68	164.68	164.68	164.68
$\Delta P_{\delta p_2}$ [W]	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
$\Delta P_{p_2}$ [W]	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85
$B_{p_2}$ [T]	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
$\Delta P_{Fed}$ [W]	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57
$\Delta P_{Fe}$ [W]	81.62	81.62	66.24	63.17	71.37	83.67	91.87	57.02
$\Delta P_{mech}$ [W]	79.85	79.85	79.85	79.85	79.85	79.85	79.85	79.85
$\Delta P_d$ [W]	18.03	18.03	18.03	18.03	18.03	18.03	18.03	18.03
$I_0$ [A]	3.08	3.76	3.76	4.12	3.94	3.40	3.36	3.79
$I_{0\check{c}}$ [A]	0.37	0.43	0.41	0.45	0.44	0.40	0.41	0.40
$\Delta P_{j10}$ [W]	91.74	136.89	136.89	164.83	150.20	112.03	109.35	139.00
$\cos \varphi_0$	0.12	0.11	0.11	0.11	0.11	0.12	0.12	0.11
$\Sigma P$ [W]	253.21	298.36	282.99	307.85	301.43	275.55	281.07	275.87
<b>Pro teplotní třídu izolace E</b>								
$I_{0\check{c}}$ [A]	0,35	0,41	0,38	0,42	0,41	0,38	0,39	0,37
$\Delta P_{j10}$ [W]	80,03	119,42	119,42	143,79	131,03	97,73	95,39	121,25
$\cos \varphi_0$	0,11	0,11	0,10	0,10	0,10	0,11	0,12	0,10
$\Sigma P$ [W]	241,50	280,89	265,51	286,81	282,25	261,25	267,11	258,12

Obrázek A.15: Tabulka s výslednými ztrátami pro teplotní třídu F a E.