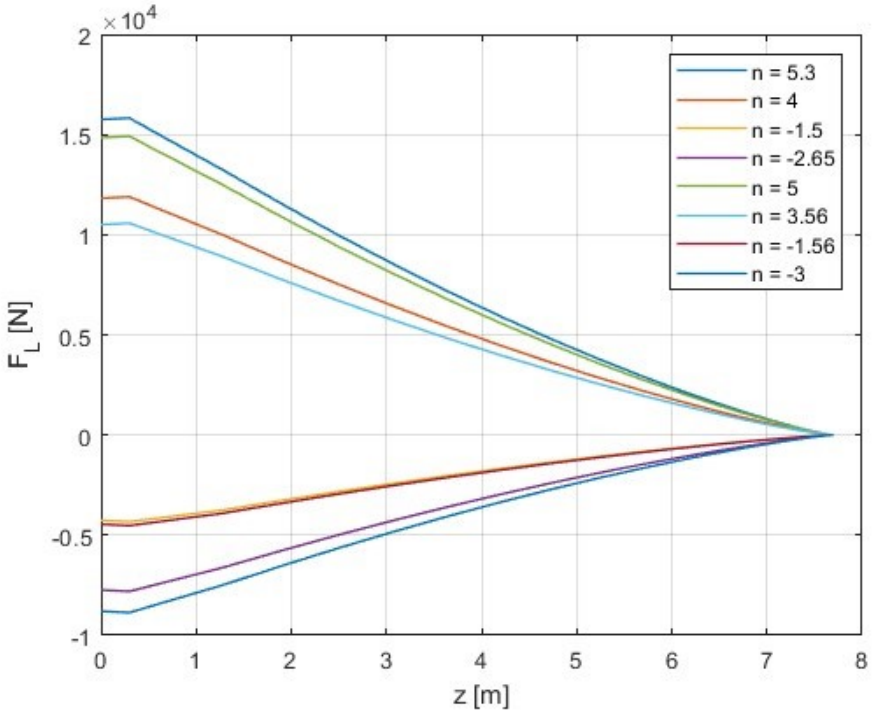
Přílohy

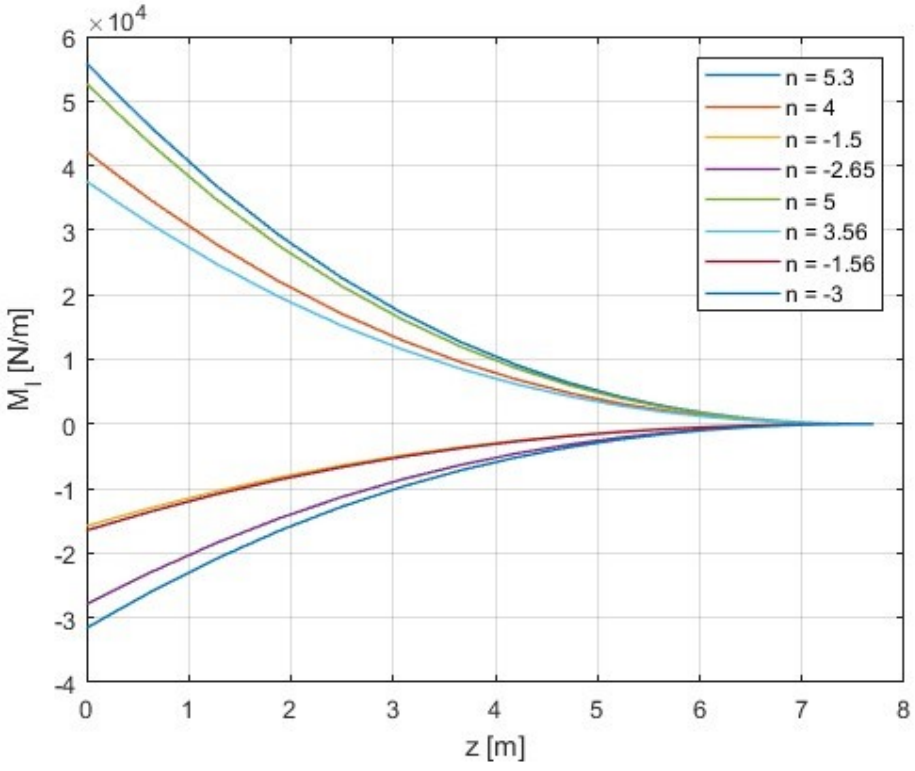
Příloha 1 Seznam profilů používaných kluzáky

1 s4094 Max thickness 9.9% at 29.1% chord.
2 s4095 Max thickness 9.7% at 29.1% chord.
3 s4096 Max thickness 12.5% at 34% chord.
4 aquilasm Max thickness 9.4% at 31.3% chord.
5 e231 Max thickness 12.3% at 39.4% chord.
6 e407 Max thickness 14.4% at 36.6% chord.
7 e431 Max thickness 15.1% at 37.4% chord.
8 e432 Max thickness 16% at 37.4% chord.
9 e433 Max thickness 14.2% at 42.6% chord.
10 e434 Max thickness 13.3% at 38.6% chord.
11 e435 Max thickness 16.2% at 40.9% chord.
12 e582 Max thickness 14.7% at 37.8% chord.
13 e583 Max thickness 16.5% at 38% chord.
14 e584 Max thickness 16.6% at 38.3% chord.
15 e585 Max thickness 14.6% at 37.6% chord.
16 e587 Max thickness 16.6% at 41.1% chord.
17 e604 Max thickness 18.8% at 37.3% chord.
18 e642 Max thickness 15.1% at 39.4% chord.
19 e654 Max thickness 17.2% at 36.1% chord.
20 e655 Max thickness 17.3% at 37.3% chord.
21 e656 Max thickness 16.2% at 37% chord.
22 e657 Max thickness 15.6% at 37% chord.
23 e662 Max thickness 15% at 42.8% chord.
24 e664 Max thickness 16.6% at 45.6% chord.
26 e668 Max thickness 13.9% at 37.3% chord.
27 e678 Max thickness 15.1% at 39.8% chord.
28 e682 Max thickness 15.3% at 40.4% chord.
29 e694 Max thickness 15.4% at 40.4% chord.
30 e748 Max thickness 19.7% at 27.4% chord.
31 fx79k144 Max thickness 14.4% at 43.5% chord.
32 geminism Max thickness 15.4% at 34.2% chord.
33 hobie Max thickness 8.5% at 25% chord.
34 hobiesm Max thickness 8.6% at 25% chord.
35 hq010 Max thickness 10% at 33.9% chord.
36 hq07 Max thickness 7% at 33.9% chord.
37 hq09 Max thickness 8.1% at 33.9% chord.
38 hq1010 Max thickness 10% at 35% chord.
39 hq1012 Max thickness 12% at 35% chord.
40 hq108 Max thickness 8% at 35% chord.
41 hq109 Max thickness 9% at 35% chord.
42 hq1510 Max thickness 10% at 35% chord.
43 hq1511 Max thickness 11% at 33.9% chord.
44 hq1512 Max thickness 12% at 35% chord.
45 hq158 Max thickness 8% at 32.5% chord.
46 hq1585 Max thickness 8.6% at 35% chord.
47 hq159 Max thickness 9% at 35% chord.
48 hq159b Max thickness 9% at 37.1% chord.
49 hq2010 Max thickness 10% at 35% chord.
50 hq2012 Max thickness 12% at 35% chord.
51 hq208 Max thickness 8% at 35% chord.
52 hq209 Max thickness 9% at 35% chord.
53 hq2090sm Max thickness 9% at 35% chord.
54 hq2195 Max thickness 9.5% at 35% chord.
55 hq2510 Max thickness 10% at 35% chord.
56 hq2511 Max thickness 11% at 33.9% chord.
57 hq2512 Max thickness 12% at 35% chord.
58 hq258 Max thickness 8% at 35% chord.
59 hq259 Max thickness 9% at 35% chord.
60 hq2590sm Max thickness 9% at 35% chord.
61 hq259b Max thickness 9% at 35% chord.
62 hq300gd2 Max thickness 16.6% at 39.1% chord.
63 hq3010 Max thickness 10% at 35% chord.
64 hq3011 Max thickness 11% at 35% chord.
65 hq3012 Max thickness 12% at 35% chord.
66 hq3013 Max thickness 13% at 35% chord.
67 hq3014 Max thickness 14% at 35% chord.
68 hq3015 Max thickness 15% at 35% chord.
69 hq308 Max thickness 8% at 35% chord.
70 hq309 Max thickness 9% at 35% chord.
71 hq3510 Max thickness 10% at 35% chord.
72 hq3512 Max thickness 12% at 35% chord.
73 hq3513 Max thickness 13% at 35% chord.
74 hq3514 Max thickness 14% at 35% chord.
75 hq3518 Max thickness 18% at 35% chord.
76 hq358 Max thickness 8% at 35% chord.
77 hq359 Max thickness 9% at 35% chord.
78 psu-90-125wl Max thickness 12.5% at 35.1% chord.
79 s9000 Max thickness 9% at 28.2% chord.
80 s9026 Max thickness 9.5% at 27.3% chord.
81 s9027 Max thickness 8% at 22.9% chord.
82 s9032 Max thickness 9% at 25% chord.
83 s9033 Max thickness 7.5% at 22.8% chord.
84 s9037 Max thickness 9% at 28.5% chord.
85 saratov Max thickness 9.2% at 15% chord.
86 sokolov Max thickness 7.1% at 25% chord.
87 spicasm Max thickness 11.7% at 30% chord.
88 ua79sf18 Max thickness 18.8% at 42.8% chord.
89 ua79sff Max thickness 8.7% at 73.1% chord.
90 ua79sfm Max thickness 18.8% at 42.8% chord.
91 wb13535sm Max thickness 13.6% at 25% chord.
92 wb140 Max thickness 13.9% at 30% chord.

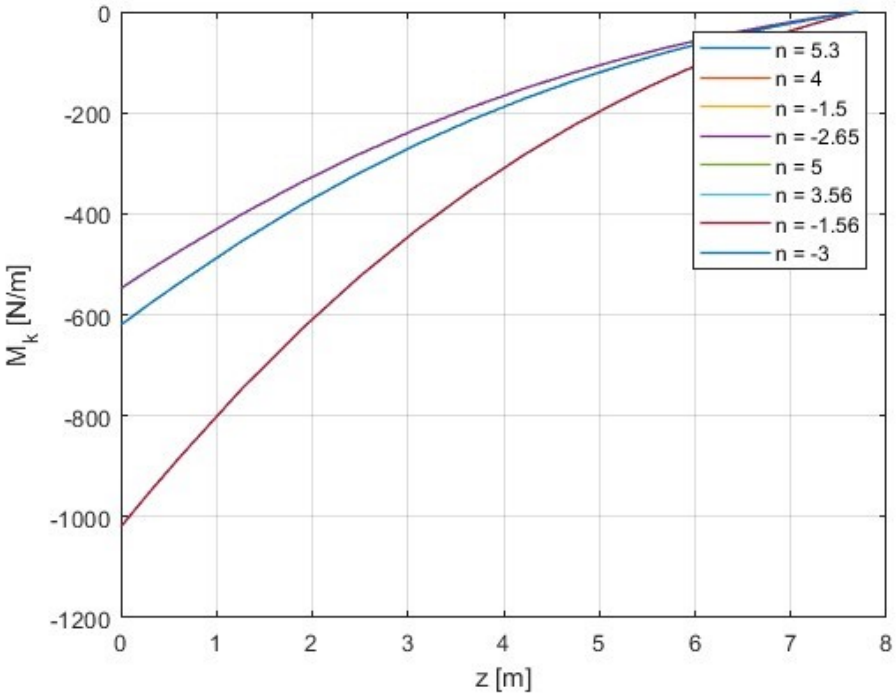
Vztlaková síla



Ohybový moment:

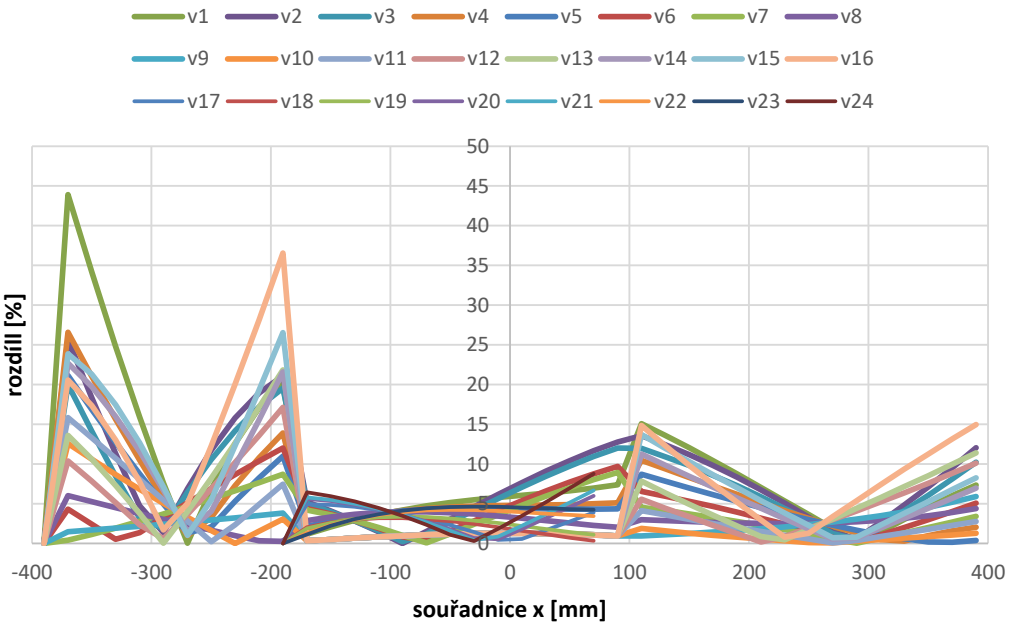


Kroutící moment:



Příloha 3 Rozdíl v redukovaném napětí mezi MKP a sestaveným modelem [%]

Zatěžování ohybem



Příloha 4 Výsledky první optimalizace

Počet komor	Poloha stojin [%]	S_k	Poloha pásnic [%]	S_{ptop}	S_{pbot}	M [kg]	T-W	Sf_q	Sf_a
4	[23 38 54 80]	[4 8 12 0 12]	[31 58]	33	13	58.93	0.977	1.131	1.005
4	[25 40 54 80]	[8 12 8 4 8]	[28 54]	34	14	57.18	0.974	1.016	1.02
4	[23 39 54 80]	[8 12 8 4 8]	[32 61]	39	13	60.41	0.954	1.14	1.003
4	[23 37 55 80]	[4 8 12 0 12]	[30 51]	38	15	59.05	1.003	1.14	1.121
4	[25 36 54 80]	[8 8 12 0 8]	[26 57]	38	12	58.41	0.917	1.032	1.116
5	[19 36 48 62 80]	[4 12 4 8 0 12]	[30 52]	34	16	59.89	0.91	1.076	1.082
5	[19 30 46 62 80]	[0 12 8 8 0 12]	[28 50]	35	15	59.16	0.994	1.025	1.008
5	[20 36 52 64 80]	[4 8 8 4 4 12]	[28 53]	40	13	61.35	0.999	1.298	1.114
5	[20 36 48 62 80]	[4 16 4 8 0 8]	[23 50]	34	17	57.12	0.896	0.968	1.069
5	[11 30 44 75 80]	[0 12 8 8 0 8]	[26 61]	40	11	63.64	0.918	1.147	1.252
6	[11 27 45 59 67 80]	[4 16 12 8 4 4 4]	[23 60]	40	10	63.06	1.003	1.499	1.034
6	[16 27 41 55 69 80]	[4 8 12 8 8 0 8]	[28 57]	33	12	59.71	0.954	1.492	1.056
6	[15 29 41 54 68 80]	[4 8 8 8 8 0 8]	[25 52]	38	12	57.97	1.003	1.588	1.013
6	[15 30 41 56 66 80]	[4 12 4 12 8 0 8]	[26 53]	30	14	58.48	0.953	1.647	1.019
6	[3 31 45 59 69 80]	[0 8 8 8 8 0 12]	[33 52]	39	16	61.96	0.969	1.209	1.057
7	[5 17 29 48 58 68 80]	[0 4 8 16 4 4 8 8]	[28 50]	40	17	62.07	0.932	1.067	1.092
7	[11 22 36 50 59 69 80]	[4 4 8 8 4 8 0 8]	[19 49]	35	15	58.1	0.746	1.186	1.117
7	[4 24 37 47 65 71 80]	[0 12 12 4 20 4 0 4]	[23 47]	36	15	59.72	0.97	1.318	1
7	[13 25 37 51 62 73 80]	[4 12 8 8 8 4 0 8]	[29 49]	37	26	61.23	0.574	1.816	1.002
7	[12 20 32 48 58 67 80]	[0 8 4 12 4 4 0 8]	[17 50]	33	13	56.36	0.982	1.049	1.168
8	[8 18 27 40 48 61 71 80]	[0 8 4 8 4 8 4 0 8]	[23 50]	32	17	55.01	0.898	0.991	1.089
8	[3 21 30 42 51 63 69 80]	[0 4 8 8 4 8 4 0 8]	[28 50]	36	18	53.97	0.881	1.002	1.023
8	[2 20 30 39 49 59 68 80]	[8 4 8 4 8 8 4 0 8]	[24 47]	34	17	54.22	0.873	1.012	1.151
8	[8 22 33 40 52 61 76 80]	[0 12 8 4 8 4 4 0 8]	[27 61]	30	11	58.77	0.998	1.076	1.327
8	[10 22 32 39 49 60 68 80]	[0 8 8 4 8 8 4 0 8]	[25 52]	30	13	55.29	0.954	1.173	1.115

Příloha 5 Výsledky druhé optimalizace

Počet komor	Poloha stojin [%]	Sk	Poloha pásnic [%]	S_{ptop}	S_{pbot}	M [kg]	T-W	Sf_q	Sf_a
4	[23 38 54 80]	[4 8 12 0 12]	[24 56]	28	12	59.35	0.948	1.094	1.001
4	[25 40 54 80]	[4 12 12 0 12]	[33 50]	32	20	57.74	0.996	1.02	1.028
4	[23 39 54 80]	[4 12 12 0 12]	[31 51]	32	16	58.88	0.944	1.246	1.001
4	[23 37 55 80]	[4 8 12 0 12]	[25 53]	32	12	59.71	0.942	1.114	1.01
4	[25 36 54 80]	[8 4 12 0 12]	[25 55]	32	12	60.2	0.973	1.322	1.015
5	[19 36 48 62 80]	[4 12 4 8 0 12]	[23 54]	28	12	60.85	0.887	1.185	0.992
5	[19 30 46 62 80]	[4 8 12 12 0 8]	[27 56]	32	12	58.66	0.96	0.984	1.016
5	[20 36 52 64 80]	[4 8 8 8 0 12]	[24 53]	32	12	60.86	0.914	1.424	0.999
5	[20 36 48 62 80]	[8 12 4 8 0 8]	[26 56]	32	12	57.12	0.973	1.058	1.059
5	[11 30 44 75 80]	[0 8 4 20 0 20]	[20 44]	32	16	87.53	0.507	1.069	1.003
6	[11 27 45 59 67 80]	[0 8 12 8 4 0 8]	[18 55]	32	12	61.08	0.779	1.013	0.994
6	[16 27 41 55 69 80]	[4 8 8 8 8 0 8]	[27 56]	32	16	57.69	0.789	1.44	0.999
6	[15 29 41 54 68 80]	[4 8 4 8 8 0 8]	[17 55]	32	12	58.24	0.827	1.007	1.025
6	[15 30 41 56 66 80]	[4 8 4 12 4 0 8]	[19 53]	32	12	56.89	0.891	1.017	0.998
6	[3 31 45 59 69 80]	[0 8 8 8 4 0 12]	[29 49]	32	16	58.87	0.956	1.179	1.016
7	[5 17 29 48 58 68 80]	[0 4 8 20 4 4 0 8]	[29 56]	32	12	60.32	0.978	1.019	1.041
7	[11 22 36 50 59 69 80]	[0 8 8 8 4 4 0 8]	[20 54]	32	12	55.91	0.893	1.212	1.099
7	[4 24 37 47 65 71 80]	[0 8 8 4 16 4 0 8]	[23 52]	32	12	60.42	0.945	1.085	1.027
7	[13 25 37 51 62 73 80]	[4 8 8 12 4 4 0 8]	[31 61]	32	12	58.52	1	1.142	1.028
7	[12 20 32 48 58 67 80]	[0 8 8 12 4 4 0 8]	[25 54]	32	12	55.87	1	1.043	1
8	[8 18 27 40 48 61 71 80]	[0 8 4 8 4 8 4 0 8]	[23 50]	32	16	54.69	0.974	0.991	1.085
8	[3 21 30 42 51 63 69 80]	[16 8 8 8 4 8 4 4 4]	[19 55]	32	12	57.65	0.898	0.991	1.04
8	[2 20 30 39 49 59 68 80]	[8 4 8 4 8 8 4 0 8]	[21 53]	24	12	53.88	0.977	1.003	1.12
8	[8 22 33 40 52 61 76 80]	[0 12 8 4 8 4 12 0 8]	[31 56]	28	16	60.72	0.788	1.071	0.999
8	[10 22 32 39 49 60 68 80]	[0 8 4 8 4 8 4 0 8]	[23 59]	24	12	54.21	0.903	1.248	1.019

Příloha 6 Výsledky optimalizace geometrie ro násobek 5,3

Počet komor	Poloha stojin [%]	Sk	Poloha pásnic [%]	S_{ptop}	S_{pbot}	M [kg]	T-W	Sf_q	Sf_a
4	[25 40 54 80]	[8 12 8 4 8]	[31 55]	34	21	58.51	0.662	1.039	1.003
4	[25 40 54 80]	[8 12 8 4 8]	[31 55]	34	21	58.51	0.662	1.039	1.003
4	[25 40 54 80]	[8 12 8 4 8]	[31 55]	34	21	58.51	0.662	1.039	1.003
4	[25 40 54 80]	[8 12 8 4 8]	[31 55]	34	21	58.51	0.662	1.039	1.003
4	[25 40 54 80]	[8 12 8 4 8]	[31 55]	34	21	58.51	0.662	1.039	1.003
5	[19 37 49 62 80]	[4 16 4 8 0 8]	[28 53]	34	23	58.33	0.56	1.065	1.005
5	[19 37 49 62 80]	[4 16 4 8 0 8]	[28 53]	34	23	58.33	0.56	1.065	1.005
5	[19 37 49 62 80]	[4 16 4 8 0 8]	[28 53]	34	23	58.33	0.56	1.065	1.005
5	[19 37 49 62 80]	[4 16 4 8 0 8]	[28 53]	34	23	58.33	0.56	1.065	1.005
5	[19 37 49 62 80]	[4 16 4 8 0 8]	[28 53]	34	23	58.33	0.56	1.065	1.005
6	[16 28 40 56 66 80]	[4 8 4 12 4 0 8]	[22 50]	32	21	56.92	0.557	1.06	1.001
6	[16 29 41 56 66 80]	[4 8 4 12 4 0 8]	[22 50]	32	21	56.83	0.56	1.008	1.001
6	[16 29 41 56 66 80]	[4 8 4 12 4 0 8]	[25 53]	32	21	57.1	0.558	1.087	1.012
6	[16 29 41 56 66 80]	[4 8 4 12 4 0 8]	[25 53]	32	21	57.1	0.558	1.087	1.012
6	[16 29 41 56 66 80]	[4 8 4 12 4 0 8]	[25 53]	32	21	57.1	0.558	1.087	1.012
7	[12 24 36 51 60 67 80]	[0 8 8 12 4 4 0 8]	[31 57]	32	20	56.72	0.671	0.999	0.999
7	[12 24 37 51 60 68 80]	[0 8 8 12 4 4 0 8]	[24 48]	32	20	55.58	0.73	1.084	1.002
7	[12 24 36 51 60 68 80]	[0 8 8 12 4 4 0 8]	[28 54]	32	20	56.75	0.636	1.055	1.016
7	[12 24 36 51 59 69 80]	[0 8 8 12 4 4 0 8]	[27 53]	32	20	57.35	0.64	1.063	1.049
7	[12 24 36 51 60 67 80]	[0 8 8 12 4 4 0 8]	[31 57]	32	20	56.72	0.671	0.999	0.999
8	[11 21 30 41 50 62 72 80]	[0 8 4 8 4 8 4 0 8]	[22 55]	24	16	54.58	0.676	1.115	1.003
8	[11 21 30 39 48 59 68 80]	[0 8 4 8 4 8 4 0 8]	[17 50]	24	16	54.3	0.684	1.159	1.154
8	[11 21 30 41 50 62 72 80]	[0 8 4 8 4 8 4 0 8]	[22 55]	24	16	54.58	0.676	1.115	1.003
8	[9 20 30 39 49 61 71 80]	[0 8 4 8 4 8 4 0 8]	[20 55]	24	16	55.55	0.628	1.164	1
8	[11 22 31 41 50 62 72 80]	[0 8 4 8 4 8 4 0 8]	[26 61]	24	16	55.39	0.646	1.096	1.009

Příloha 7 Skladba ověřovacích konstrukcí po profilu křídla

Symetrická skladba		Nesymetrická skladba	
označení skladby	skladba	označení skladby	skladba
s_1	[45/-45/-45/45]3	s_1	[45/-45]5/45
s_2	[45/-45/-45/45]4	s_2	[45/-45]3/45/[45/-45]4/45
s_3	[45/-45/-45/45]5	s_3	[45/-45]10/45
s_4	[45/-45/-45/45]2	s_4	[45/-45]6/45
s_5	[45/-45/-45/45]2/[0]32/[45/-45/-45/45]2	s_5	[45/-45]4/46
s_6	[45/-45/-45/45/45/-45]/[0]32/[-45/45/45/-45/-45/45]	s_6	[45/-45]3/[45]2 /[0]34/-45/[45/-45]3/45
s_7	[45/-45/-45/45/45/-45]2/[0]32/[-45/45/45/-45/-45/45]4	s_7	[45/-45]2/[45]2 /-45/[0]34/[45/-45]3/45
s_8	[45/-45/-45/45]2/45/-45/[0]32/-45/45/[45/-45/-45/45]2	s_8	[45/-45]5/[0]34/[45/-45]5/45
s_9	[45/-45/-45/45/45/-45]/[0]23/[-45/45/45/-45/-45/45]	s_9	[45/-45]3/[45]2 /[0]21/-45/[45/-45]3/45
s_{10}	[45/-45/-45/45/45/-45]2/[0]23/[-45/45/45/-45/-45/45]4	s_{10}	[45/-45]2/[45]2 /-45/[0]21/[45/-45]3/45
s_{11}	[45/-45/-45/45]2/45/-45/[0]23/-45/45/[45/-45/-45/45]2	s_{11}	[45/-45]5/[0]21/[45/-45]5/45
s_{12}	[45/-45/-45/45]/[-45/45/45/-45]2	s_{12}	[45/-45]/[-45/45]3/-45
s_{13}	[45/-45/-45/45]2/[-45/45/45/-45]	s_{13}	[45/-45]6
s_{14}	[45/-45/-45/45]/[-45/45/45/-45]3	s_{14}	[45/-45]8/-45
s_{15}	[45/-45/-45/45]3/[-45/45/45/-45]	s_{15}	[45/-45]6/[-45/45]2
s_{16}	[45/-45/-45/45]	s_{16}	[45/-45]2

Příloha 8 Součinitele bezpečnosti pro všechny body obálky násobků

Symetrická skladba

n	TWf	SF_q	Sf_a
5.3	0.53	1.02	1.01
4	0.36	6.34	1.37
-1.5	0.14	1.54	2.13
-2.65	0.29	1.61	1.21
5	0.49	2.09	1.1
3.56	0.31	10.84	1.54
-1.56	0.15	1.52	2.04
-3	0.34	1.17	1.141

Nesymetrická sklatba

n	TWf	SF_q	Sf_a
5.3	0.62	1.08	1.01
4	0.41	5.14	1.34
-1.5	0.17	1.82	2.04
-2.65	0.36	1.83	1.16
5	0.57	2.12	1.07
3.56	0.35	7.45	1.5
-1.56	0.18	1.79	1.96
-3	0.42	1.43	1.02

Příloha 9 Výsledky navržené kontrolní konstrukce

	n = 5.3			n = 4			n = -1.5			n = -2.65		
Úsek	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x
I	0.72	1.46	1.01	0.58	4.48	1.34	0.23	3.84	3.56	0.46	4.73	2.02
II	0.65	1.51	1.17	0.46	4.91	1.55	0.22	3.78	4.14	0.42	4.91	2.34
III	0.5	1.56	1.04	0.35	5.76	1.38	0.19	3.4	3.68	0.37	5.34	2.08
IV	0.45	1.45	1.1	0.32	6.93	1.46	0.15	2.63	3.89	0.29	5.45	2.2
V	0.53	3.73	1.24	0.37	19.67	1.64	0.17	6.41	4.37	0.33	14.44	2.47

	n = 5			n = 3.56			n = -1.56			n = -3		
Úsek	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x	T-W	Sf_q	Sf_x
I	0.67	1.59	1.07	0.44	7.21	1.5	0.25	4.03	3.41	0.54	4.16	1.78
II	0.53	1.65	1.24	0.4	8.18	1.74	0.23	3.96	3.97	0.5	4.34	2.07
III	0.46	1.71	1.1	0.31	10.87	1.55	0.2	3.55	3.52	0.43	4.72	1.84
IV	0.41	1.6	1.17	0.21	18.96	1.64	0.16	2.73	3.73	0.33	4.82	1.95
V	0.34	4.11	1.31	0.32	67.78	1.84	0.18	6.64	4.19	0.38	12.78	2.18

Příloha 10 Seznam naprogramovaných funkcí a skriptů

Název	Funkce/skript	Krátký popis
geneticAlg_sever.m	Skript	Spouštěcí skript po Genetický algoritmus
th_WingBeamFinFit	Skript	Skript pro pevnostní výpočet konstrukce
custgaoutfun.m	Funkce	Vlastní vytvořená Funkce pro získání dat z genetického algoritmu
th_ABBD.m	Funkce	Přiřazení materiálových vlastností do struktur
th_ABBD_lok.m	Funkce	Výpočet ABBD matice
th_AddPoint.m	Funkce	Přidání bodů do geometrie
th_buckLoad.m	Funkce	Výpočet kritických zatížení pro stabilitu
th_CompBeamProp.m	Funkce	Výpočet vlastností kompozitních nosníků dle [9]
th_CompBeamPropStruct.m	Funkce	Přiřazení vlastností do struktur
th_DivData.m	Funkce	Dělení geometrie
th_MaterialAss2.m	Funkce	Přiřazení materiálových vlstností
th_PosPrep.m	Funkce	Umístění geometrie do souřadného systému
th_ShearFlowAdd.m	Funkce	Přičtení uzavíracího smykového toku
th_ShearFlowCalc.m	Funkce	Výpočet smykových toků v konstrukci
th_sig_lok3.m	Funkce	Přiřazení lokálních napětí do struktur
th_StructEval.m	Funkce	Výpočet lokální napjatosti a pevnostních kritérií
th_SumCell.m	Funkce	Součet proměnných typu „cell“
th_WBFitnessOb.m	Funkce	Fitness funkce pro genetický algoritmus
VMstress.m	Funkce	Výpočet redukovaného napětí