

# Solução do Problema ETAMACRO - Solver HiGHS

Análise Computacional

17 de setembro de 2025

## 1 Informações do Problema

### Informações do Problema:

- Nome: ETAMACRO
- Número de Variáveis: 688
- Número de Restrições: 400
- Inviabilidade Primal: 0.000e+00
- Inviabilidade Dual: 0.000e+00
- Valor Primal: -7.557e+02
- Valor Dual: -5.108e+01
- Gap: -1.989e-19
- Número de Iterações: 30

## 2 Variáveis Primais e Custos Reduzidos

Tabela 1: Variáveis primais e custos reduzidos do problema ETAMACRO

Coordenada x	Valor x	Coordenada z	Valor z
1	3.750000	1	-188.714422
2	4.144580	2	0.000001
3	4.575950	3	0.000006
4	6.960707	4	0.000000
5	7.500352	5	0.000000
6	6.158640	6	0.000000
7	7.337342	7	0.000000
8	7.507350	8	0.000000
9	9.640538	9	0.000000
10	11.408917	10	0.000000
11	10.103910	11	0.000000
12	11.155530	12	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
13	14.811591	13	0.000000
14	18.396977	14	0.000000
15	17.537723	15	0.000000
16	17.438699	16	0.000000
17	1.980000	17	-29.168970
18	2.197436	18	0.000000
19	2.404627	19	0.000000
20	4.450096	20	0.000000
21	5.240762	21	0.000000
22	6.691204	22	0.000000
23	8.363578	23	0.000000
24	9.696233	24	0.000000
25	10.069766	25	0.000000
26	9.623670	26	0.000000
27	10.060242	27	0.000000
28	10.590894	28	0.000000
29	10.783259	29	0.000000
30	11.476740	30	0.000000
31	13.452820	31	0.000000
32	15.655719	32	0.000000
33	0.508000	33	-129.204824
34	0.512700	34	0.000000
35	0.508000	35	0.000010
36	0.799595	36	0.000000
37	0.726577	37	0.000000
38	0.674020	38	0.000000
39	0.606314	39	0.000000
40	0.611039	40	0.000000
41	0.651358	41	0.000000
42	0.787797	42	0.000000
43	1.004836	43	0.000000
44	0.917613	44	0.000000
45	0.908673	45	0.000000
46	0.840528	46	0.000000
47	0.695600	47	0.000000
48	1.693784	48	0.000000
49	0.200000	49	573.135297
50	0.228981	50	0.000000
51	0.246207	51	0.000000
52	0.912400	52	-0.000003
53	0.000000	53	0.000001
54	0.014359	54	0.000000
55	0.762351	55	0.000000
56	0.000000	56	0.000003
57	1.173090	57	-0.000000
58	0.400711	58	0.000000
59	0.000000	59	0.000000
60	0.972368	60	0.000000
61	1.256990	61	-0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
62	1.268690	62	-0.000000
63	0.000000	63	0.000000
64	1.046322	64	0.000000
65	0.134018	65	0.000000
66	0.140918	66	0.000000
67	0.147140	67	0.000000
68	0.265932	68	0.000000
69	0.289453	69	0.000000
70	0.370603	70	0.000000
71	0.389325	71	0.000000
72	0.490193	72	0.000000
73	0.554725	73	0.000000
74	0.612680	74	0.000000
75	0.754583	75	0.000000
76	0.766637	76	0.000000
77	0.706839	77	0.000000
78	0.681736	78	0.000000
79	0.639092	79	0.000000
80	1.285300	80	-0.000000
81	0.305000	81	17.804450
82	0.345000	82	-0.225996
83	0.390000	83	-0.244220
84	0.442000	84	-0.211926
85	0.500000	85	-0.441179
86	0.565000	86	-0.018232
87	0.640000	87	-0.015894
88	0.724000	88	-0.079982
89	0.819000	89	-0.124874
90	0.927000	90	-0.079646
91	1.048000	91	-0.035774
92	1.186000	92	-0.023206
93	1.342000	93	-0.014788
94	1.518000	94	-0.009567
95	1.718000	95	-0.004219
96	1.944000	96	-0.005526
97	1.535000	97	12.292360
98	1.279000	98	-2.271000
99	1.023000	99	-0.974952
100	0.768000	100	-0.322888
101	0.512000	101	-0.215893
102	0.256000	102	0.068780
103	0.000000	103	0.311772
104	0.000000	104	0.254290
105	0.000000	105	0.155389
106	0.000000	106	0.115553
107	0.000000	107	0.125316
108	0.000000	108	0.125618
109	0.000000	109	0.126424
110	0.000000	110	0.104286

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Coordenada x	Valor x	Coordenada z	Valor z
111	0.000000	111	0.000112
112	0.000000	112	0.000527
113	0.000000	113	16.018393
114	0.229218	114	0.000000
115	0.460813	115	0.000000
116	1.381001	116	0.000000
117	1.799668	117	0.000000
118	2.482244	118	0.000000
119	3.198757	119	0.000000
120	3.327757	120	0.000000
121	3.179834	121	0.000000
122	3.186833	122	0.000000
123	3.148834	123	0.000000
124	3.347076	124	0.000000
125	3.243077	125	0.000000
126	3.113077	126	0.000000
127	3.167999	127	0.000000
128	2.991000	128	0.000000
129	0.000000	129	22.463441
130	-0.000000	130	0.000000
131	-0.000000	131	0.000000
132	-0.000000	132	0.000000
133	-0.000000	133	0.000000
134	-0.000000	134	0.000000
135	-0.000000	135	0.000000
136	-0.000000	136	0.000000
137	-0.000000	137	0.000000
138	-0.000000	138	0.000000
139	-0.000000	139	0.000000
140	-0.000000	140	0.000000
141	-0.000000	141	0.000000
142	-0.000000	142	0.000000
143	-0.000000	143	0.000000
144	-0.000000	144	0.000000
145	0.155000	145	16.634028
146	0.344218	146	0.000000
147	0.530813	147	0.000000
148	1.289095	148	0.000000
149	1.289095	149	0.000000
150	1.289095	150	0.000000
151	1.134095	151	0.000000
152	0.944876	152	0.000000
153	0.758281	153	0.000000
154	-0.000000	154	0.000000
155	-0.000000	155	0.000000
156	-0.000000	156	0.000000
157	-0.000000	157	0.000000
158	-0.000000	158	0.000000
159	-0.000000	159	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
160	-0.000000	160	0.000000
161	0.000000	161	17.069953
162	0.000000	162	-0.512595
163	0.000000	163	-0.049233
164	0.285000	164	-0.105384
165	0.570000	165	-0.401193
166	1.494865	166	0.000000
167	2.636727	167	0.000000
168	3.447600	168	0.000000
169	3.447600	169	0.000000
170	3.162600	170	0.000000
171	2.877600	171	0.000000
172	1.952735	172	0.000000
173	0.810873	173	0.000000
174	-0.000000	174	0.000000
175	-0.000000	175	0.000000
176	-0.000000	176	0.000000
177	0.000000	177	16.994385
178	0.000000	178	-0.476915
179	0.000000	179	-0.031252
180	0.285000	180	-0.072090
181	0.570000	181	-0.218558
182	0.570000	182	0.000000
183	0.570000	183	0.000000
184	0.570000	184	0.000000
185	0.570000	185	0.000000
186	0.285000	186	0.000000
187	-0.000000	187	0.000000
188	-0.000000	188	0.000000
189	-0.000000	189	0.000000
190	-0.000000	190	0.000000
191	-0.000000	191	0.000000
192	-0.000000	192	0.000000
193	0.000000	193	21.045350
194	-0.000000	194	0.000000
195	0.000000	195	0.797279
196	0.000000	196	-0.507416
197	0.000000	197	-0.394743
198	0.034000	198	-0.064195
199	0.184000	199	-0.115260
200	0.682000	200	-0.000000
201	1.295051	201	0.000000
202	2.062238	202	0.000000
203	2.985809	203	0.000000
204	4.105083	204	0.000000
205	5.387309	205	0.000000
206	6.845663	206	0.000000
207	8.566821	207	0.000000
208	10.720719	208	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
209	0.000000	209	56.733185
210	-0.000000	210	0.000000
211	0.000000	211	10.228175
212	-0.000000	212	0.000000
213	0.000000	213	1.506109
214	0.000000	214	1.044685
215	0.000000	215	0.570957
216	0.000000	216	0.256794
217	0.000000	217	0.143726
218	-0.000000	218	0.000000
219	-0.000000	219	0.000000
220	-0.000000	220	0.000000
221	-0.000000	221	0.000000
222	-0.000000	222	0.000000
223	-0.000000	223	0.000000
224	-0.000000	224	0.000000
225	46.300000	225	0.000000
226	46.300000	226	0.000000
227	45.310000	227	0.000000
228	73.899500	228	0.000000
229	65.482698	229	0.000000
230	55.801815	230	0.000000
231	44.339387	231	0.000000
232	34.308925	232	0.000000
233	18.858066	233	0.000000
234	14.591902	234	0.000000
235	9.715853	235	0.000000
236	1.423654	236	0.000000
237	1.101601	237	0.000000
238	-0.000000	238	0.000000
239	-0.000000	239	0.000000
240	-0.000000	240	0.000000
241	0.000000	241	2.099289
242	-0.000000	242	0.000000
243	0.000000	243	0.294998
244	0.000000	244	0.096558
245	0.000000	245	0.012001
246	1.814956	246	0.000000
247	1.814956	247	0.000000
248	1.814956	248	0.000000
249	3.207775	249	0.000000
250	3.207775	250	0.000000
251	3.207775	251	0.000000
252	1.392819	252	0.000000
253	1.392819	253	0.000000
254	1.392819	254	0.000000
255	-0.000000	255	0.000000
256	-0.000000	256	0.000000
257	0.000000	257	2.119804

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Coordenada x	Valor x	Coordenada z	Valor z
258	-0.000000	258	0.000000
259	0.000000	259	0.386814
260	-0.000000	260	0.000000
261	0.485000	261	0.000000
262	2.000000	262	-0.003772
263	3.710000	263	-0.074555
264	6.000000	264	-0.054220
265	8.290000	265	-0.034857
266	10.000000	266	-0.014913
267	11.010000	267	-0.004019
268	11.540000	268	-0.002118
269	11.790000	269	-0.001188
270	11.900000	270	-0.000668
271	11.960000	271	-0.000374
272	11.990000	272	-0.000566
273	0.000000	273	4.555938
274	-0.000000	274	0.000000
275	0.000000	275	1.035593
276	-0.000000	276	0.000000
277	0.000000	277	0.133831
278	0.405200	278	0.000000
279	2.617100	279	0.000000
280	9.980000	280	-0.023806
281	24.840000	281	-0.023090
282	40.009990	282	-0.008149
283	64.440000	283	-0.000207
284	64.034800	284	0.000000
285	61.822900	285	0.000000
286	54.460000	286	0.000000
287	39.600000	287	0.000000
288	137.518376	288	0.000000
289	4.500000	289	-0.291232
290	4.970000	290	-0.215603
291	5.490000	291	-0.173763
292	6.060000	292	-0.153079
293	6.690000	293	-0.118943
294	7.380000	294	-0.089301
295	8.150000	295	-0.051377
296	9.000000	296	-0.040230
297	9.940000	297	-0.025882
298	10.970000	298	-0.014252
299	12.110000	299	-0.004559
300	13.370000	300	-0.002084
301	14.760000	301	-0.000992
302	16.300000	302	-0.000432
303	18.000000	303	-0.000356
304	19.870000	304	-0.000624
305	-0.000000	305	0.000000
306	0.000000	306	-0.180665

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Coordenada x	Valor x	Coordenada z	Valor z
307	-0.000000	307	0.000000
308	0.000000	308	-0.091553
309	-0.000000	309	0.000000
310	0.000000	310	-0.089347
311	-0.000000	311	0.000000
312	0.000000	312	-0.135255
313	-0.000000	313	0.000000
314	0.000000	314	-0.044697
315	-0.000000	315	0.000000
316	0.000000	316	-0.001119
317	-0.000000	317	0.000000
318	0.000000	318	0.000792
319	-0.000000	319	0.000000
320	0.000000	320	0.000800
321	0.061000	321	0.000000
322	0.008000	322	0.000000
323	0.009000	323	0.000000
324	0.010400	324	0.000000
325	0.011600	325	0.000000
326	0.013000	326	0.000000
327	0.076000	327	0.000000
328	0.024800	328	0.000000
329	0.028000	329	0.000000
330	0.032000	330	0.000000
331	0.035800	331	0.000000
332	0.040600	332	0.000000
333	0.107200	333	0.000000
334	0.060000	334	0.000000
335	0.068000	335	0.000000
336	0.077200	336	0.000000
337	-0.000000	337	0.000000
338	0.045844	338	0.000000
339	0.046319	339	0.000000
340	0.184037	340	0.000000
341	0.083733	341	0.000000
342	0.136515	342	0.000000
343	0.143302	343	0.000000
344	0.071644	344	0.000000
345	0.016734	345	0.000000
346	0.185437	346	0.000000
347	0.076134	347	0.000000
348	0.176164	348	0.000000
349	0.122503	349	0.000000
350	0.045644	350	0.000000
351	0.027719	351	0.000000
352	0.150037	352	0.000000
353	-0.000000	353	0.000000
354	0.000000	354	12.650220
355	0.000000	355	7.941358

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Coordenada x	Valor x	Coordenada z	Valor z
356	0.000000	356	4.787711
357	0.000000	357	2.611029
358	0.000000	358	1.445469
359	0.000000	359	0.811498
360	0.000000	360	0.462678
361	0.000000	361	0.263160
362	0.000000	362	0.149223
363	0.000000	363	0.087255
364	0.000000	364	0.049130
365	0.000000	365	0.027955
366	0.000000	366	0.016076
367	0.000000	367	0.009398
368	0.000000	368	0.005656
369	0.031000	369	0.000000
370	0.037844	370	0.000000
371	0.037319	371	0.000000
372	0.151656	372	0.000000
373	0.000000	373	0.222893
374	0.000000	374	1.888424
375	0.000000	375	1.506372
376	0.000000	376	1.073405
377	0.000000	377	0.707783
378	0.000000	378	0.738150
379	0.000000	379	0.751402
380	0.000000	380	0.521206
381	0.000000	381	0.293305
382	0.000000	382	0.126607
383	0.000000	383	0.082375
384	0.000000	384	0.081431
385	-0.000000	385	0.000000
386	0.000000	386	2.389198
387	-0.000000	387	0.000000
388	0.057000	388	0.000000
389	0.057000	389	0.000000
390	0.184973	390	0.000000
391	0.228372	391	0.000000
392	0.162175	392	0.000000
393	0.000000	393	0.017489
394	0.000000	394	0.284253
395	0.000000	395	0.448296
396	0.000000	396	0.344474
397	0.000000	397	0.206303
398	0.000000	398	0.089174
399	0.000000	399	0.050499
400	0.000000	400	0.064039
401	-0.000000	401	0.000000
402	0.000000	402	2.182563
403	-0.000000	403	0.000000
404	0.057000	404	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
405	0.057000	405	0.000000
406	0.000000	406	0.702723
407	0.000000	407	0.464929
408	0.000000	408	0.214183
409	0.000000	409	0.085660
410	0.000000	410	0.278722
411	0.000000	411	0.414064
412	0.000000	412	0.315087
413	0.000000	413	0.190418
414	0.000000	414	0.081626
415	0.000000	415	0.036560
416	0.000000	416	0.053859
417	-0.000000	417	0.000000
418	0.000000	418	4.691529
419	-0.000000	419	0.000000
420	0.000000	420	2.551149
421	-0.000000	421	0.000000
422	0.006800	422	0.000000
423	0.030000	423	0.000000
424	0.099600	424	0.000000
425	0.122610	425	0.000000
426	0.153437	426	0.000000
427	0.184714	427	0.000000
428	0.230655	428	0.000000
429	0.286445	429	0.000000
430	0.391271	430	0.000000
431	0.466842	431	0.000000
432	0.584217	432	0.000000
433	-0.000000	433	0.000000
434	0.000000	434	66.814445
435	-0.000000	435	0.000000
436	0.000000	436	17.187340
437	-0.000000	437	0.000000
438	-0.000000	438	0.000000
439	-0.000000	439	0.000000
440	-0.000000	440	0.000000
441	-0.000000	441	0.000000
442	0.000000	442	0.387687
443	0.000000	443	0.250082
444	0.000000	444	0.116332
445	0.000000	445	0.058724
446	0.000000	446	0.035262
447	0.000000	447	0.028337
448	0.000000	448	0.018748
449	9.260000	449	0.000000
450	0.000000	450	0.000000
451	1.896797	451	0.000000
452	7.338770	452	0.000000
453	0.000000	453	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
454	1.026464	454	0.000000
455	-0.000000	455	0.000000
456	0.000000	456	0.260641
457	0.000000	457	0.419288
458	0.000000	458	0.502300
459	0.000000	459	0.483105
460	0.000000	460	0.395899
461	0.000000	461	0.275708
462	0.000000	462	0.124930
463	-0.000000	463	0.000000
464	-0.000000	464	0.000000
465	-0.000000	465	0.000000
466	0.000000	466	3.475761
467	-0.000000	467	0.000000
468	-0.000000	468	0.000000
469	-0.000000	469	0.000000
470	0.362991	470	0.000000
471	0.000000	471	0.093308
472	0.000000	472	0.000000
473	0.278564	473	0.000000
474	0.000000	474	0.011243
475	0.000000	475	0.026459
476	0.000000	476	0.019152
477	0.000000	477	0.012017
478	0.000000	478	0.006687
479	0.000000	479	0.002751
480	0.000000	480	0.001401
481	-0.000000	481	0.000000
482	0.000000	482	3.479697
483	-0.000000	483	0.000000
484	0.000000	484	0.468974
485	0.097000	485	0.000000
486	0.303000	486	-0.067312
487	0.342000	487	0.000000
488	0.458000	488	0.000000
489	0.458000	489	0.000000
490	0.342000	490	0.000000
491	0.299000	491	0.000000
492	0.409000	492	0.000000
493	0.392000	493	0.000000
494	0.480000	494	0.000000
495	0.470000	495	0.000000
496	0.348000	496	0.000000
497	-0.000000	497	0.000000
498	0.000000	498	7.672044
499	-0.000000	499	0.000000
500	0.000000	500	1.591128
501	-0.000000	501	0.000000
502	0.081040	502	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
503	0.442380	503	-0.241399
504	1.472580	504	-0.048972
505	2.972000	505	0.000000
506	3.033998	506	0.000000
507	4.886002	507	0.000000
508	0.000000	508	0.000000
509	0.000000	509	0.000000
510	0.000000	510	0.000000
511	0.000000	511	0.000000
512	22.617673	512	0.000000
513	0.900000	513	0.000000
514	0.094000	514	0.000000
515	0.104000	515	0.000000
516	0.114000	516	0.000000
517	0.126000	517	0.000000
518	0.138000	518	0.000000
519	1.054000	519	0.000000
520	0.264000	520	0.000000
521	0.292000	521	0.000000
522	0.320000	522	0.000000
523	0.354000	523	0.000000
524	0.390000	524	0.000000
525	1.332000	525	0.000000
526	0.572000	526	0.000000
527	0.632000	527	0.000000
528	0.694000	528	0.000000
529	-0.000000	529	0.000000
530	0.000000	530	0.269530
531	-0.000000	531	0.000000
532	0.000000	532	0.027930
533	-0.000000	533	0.000000
534	0.000000	534	0.235693
535	0.000000	535	-0.001663
536	0.000000	536	0.407043
537	-0.000000	537	0.000000
538	0.000000	538	0.163800
539	-0.000000	539	0.000000
540	0.000000	540	0.006942
541	0.000000	541	0.001663
542	-0.000000	542	0.000000
543	0.000000	543	0.001871
544	-0.000000	544	0.000000
545	52.747000	545	0.000000
546	51.671800	546	0.000000
547	49.606600	547	0.000000
548	45.974600	548	0.000000
549	0.000000	549	0.026016
550	0.000000	550	0.039729
551	0.000000	551	0.061813

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Coordenada x	Valor x	Coordenada z	Valor z
552	0.000000	552	0.073400
553	0.000000	553	0.086679
554	0.000000	554	0.094185
555	0.000000	555	0.098611
556	0.000000	556	0.101153
557	0.000000	557	0.102548
558	0.000000	558	0.108757
559	0.000000	559	0.134331
560	0.000000	560	0.133948
561	0.000000	561	0.333687
562	0.000000	562	0.151061
563	0.000000	563	0.049979
564	31.150500	564	0.000000
565	67.633098	565	0.000000
566	1.216402	566	0.000000
567	0.000000	567	0.014722
568	0.000000	568	0.022448
569	0.000000	569	0.033513
570	0.000000	570	0.039768
571	0.000000	571	0.043457
572	0.000000	572	0.045575
573	0.000000	573	0.046737
574	0.000000	574	0.052817
575	0.000000	575	0.078317
576	0.000000	576	0.077982
577	0.000000	577	1.080519
578	0.000000	578	0.532641
579	0.000000	579	0.229396
580	0.000000	580	0.079458
581	0.000000	581	0.027427
582	55.660613	582	0.000000
583	44.339387	583	0.000000
584	0.000000	584	0.000000
585	0.000000	585	0.006640
586	0.000000	586	0.010392
587	0.000000	587	0.012605
588	0.000000	588	0.013877
589	0.000000	589	0.014574
590	0.000000	590	0.020393
591	0.000000	591	0.045746
592	0.000000	592	0.045507
593	0.000000	593	2.234439
594	0.000000	594	1.138683
595	0.000000	595	0.532192
596	0.000000	596	0.232316
597	0.000000	597	0.102238
598	0.000000	598	0.033671
599	0.000000	599	0.011587
600	34.308925	600	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
601	18.858066	601	0.000000
602	14.591902	602	0.000000
603	9.715853	603	0.000000
604	1.423654	604	0.000000
605	1.101601	605	0.000000
606	0.000000	606	0.005429
607	0.000000	607	0.030562
608	0.000000	608	0.030467
609	13.403000	609	0.000000
610	14.680382	610	0.000000
611	16.031535	611	0.000000
612	24.324409	612	0.000000
613	27.656276	613	0.000000
614	36.409678	614	0.000000
615	42.860000	615	0.000000
616	45.000000	616	0.000000
617	46.550000	617	0.000000
618	47.649990	618	0.000000
619	48.410000	619	0.000000
620	48.929990	620	0.000000
621	49.280000	621	0.000000
622	49.520000	622	0.000000
623	49.679990	623	0.000000
624	49.780000	624	0.000000
625	0.007545	625	0.000000
626	0.012990	626	0.000000
627	0.036805	627	0.000000
628	0.058457	628	0.000000
629	0.076062	629	0.000000
630	0.100554	630	0.000000
631	0.114145	631	0.000000
632	0.113442	632	0.000000
633	0.000000	633	1.062308
634	0.000000	634	1.662763
635	0.000000	635	2.016860
636	0.000000	636	2.568171
637	0.000000	637	3.470008
638	0.000000	638	4.642237
639	0.000000	639	4.259217
640	0.000000	640	4.073574
641	0.000000	641	184.627152
642	0.000000	642	96.966648
643	0.000000	643	48.447408
644	0.000000	644	24.457344
645	0.000000	645	11.969830
646	0.000000	646	5.387388
647	0.000000	647	1.854014
648	0.000000	648	0.000002
649	0.108073	649	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
650	0.055794	650	0.000000
651	0.056133	651	0.000000
652	0.000000	652	0.347926
653	0.000000	653	1.138196
654	0.000000	654	2.248022
655	0.000000	655	1.829771
656	0.000000	656	1.667094
657	0.000000	657	1507.781622
658	0.000000	658	799.192548
659	0.000000	659	406.995358
660	0.000000	660	213.075674
661	0.000000	661	112.134932
662	0.000000	662	58.926863
663	0.000000	663	30.365426
664	0.000000	664	15.378829
665	0.000000	665	7.854130
666	0.000000	666	3.600904
667	0.000000	667	1.092715
668	0.029418	668	0.000000
669	0.000000	669	0.000005
670	0.000000	670	0.667809
671	-0.000000	671	0.000000
672	-0.000000	672	0.000000
673	-0.000000	673	0.000000
674	-0.000000	674	0.000000
675	-0.000000	675	0.000000
676	-0.000000	676	0.000000
677	0.038475	677	0.000000
678	0.077665	678	0.000000
679	0.126499	679	0.000000
680	0.000000	680	0.152309
681	0.000000	681	0.162104
682	0.000000	682	0.098505
683	0.000000	683	0.047788
684	0.000000	684	0.029895
685	0.000000	685	0.018108
686	0.000000	686	0.010799
687	0.000000	687	0.004783
688	0.000000	688	0.004411

### 3 Variáveis Duais (Multiplicadores de Lagrange)

Tabela 2: Variáveis duais do problema ETAMACRO

Coordenada y	Valor y
1	-0.779590
Continua na próxima página	

Coordenada y	Valor y
2	-0.414337
3	-0.212174
4	-0.112215
5	-0.060184
6	-0.032757
7	-0.018035
8	-0.010310
9	-0.005884
10	-0.003382
11	-0.001906
12	-0.001059
13	-0.000594
14	-0.000334
15	-0.000187
16	-0.000283
17	-103.227151
18	-52.328023
19	-27.594966
20	-14.715253
21	-8.019165
22	-4.349877
23	-2.492614
24	-1.415982
25	-0.817786
26	-0.464130
27	-0.256912
28	-0.144022
29	-0.080926
30	-0.045563
31	-0.025208
32	0.207173
33	-0.294005
34	0.359474
35	0.088021
36	-0.090646
37	-0.193371
38	-0.379472
39	-0.294005
40	-0.074914
41	-0.009196
42	0.000001
43	-0.000000
44	-0.000000
45	-0.000000
46	-0.000000
47	-0.000000
48	-0.000000
49	0.686011
50	-0.134731

Continua na próxima página



Coordenada y	Valor y
51	-0.014453
52	0.135969
53	0.290057
54	0.569208
55	0.686011
56	0.299657
57	0.082764
58	-0.000001
59	-0.000000
60	-0.000000
61	-0.000000
62	-0.000000
63	-0.000000
64	-0.000000
65	0.853901
66	3.359841
67	1.822765
68	1.124489
69	0.829714
70	0.868128
71	0.853901
72	0.395408
73	0.137276
74	0.030977
75	0.017451
76	0.009826
77	0.005591
78	0.003215
79	0.001880
80	0.001131
81	0.036704
82	-0.255672
83	-0.244578
84	-0.215468
85	-0.188692
86	-0.039973
87	-0.055249
88	0.053987
89	0.070386
90	0.103926
91	0.099304
92	0.060399
93	0.024526
94	0.006174
95	0.016475
96	0.010254
97	-0.281971
98	-0.000000
99	-0.389012

Continua na próxima página

Coordenada y	Valor y
100	-0.309726
101	-0.293892
102	-0.453004
103	-0.373924
104	-0.168181
105	-0.074048
106	0.009668
107	0.038682
108	0.025053
109	0.007126
110	-0.001313
111	0.010100
112	0.006776
113	-0.192162
114	-0.000000
115	-0.378165
116	-0.312869
117	-0.300738
118	-0.318337
119	-0.284115
120	-0.126854
121	-0.063201
122	0.006526
123	0.031836
124	0.019176
125	0.003948
126	-0.002823
127	0.007312
128	0.004739
129	-0.653745
130	0.919106
131	-0.310583
132	-0.000000
133	-0.635038
134	-0.844385
135	-0.783386
136	-0.590053
137	-0.382465
138	-0.213064
139	-0.114990
140	-0.068023
141	-0.038435
142	-0.020368
143	-0.009458
144	-0.004649
145	-0.282260
146	13.729416
147	0.093689
148	3.428109

Continua na próxima página

Coordenada y	Valor y
149	-0.143355
150	-0.356206
151	-0.282260
152	-0.067862
153	-0.003529
154	0.081288
155	0.050016
156	0.023266
157	0.011745
158	0.007052
159	0.005667
160	0.003750
161	-0.001177
162	0.011718
163	0.018754
164	0.022216
165	0.010789
166	0.063005
167	-0.186793
168	-0.065806
169	0.008880
170	0.096092
171	0.143183
172	0.148453
173	0.150777
174	0.124930
175	-0.000000
176	-0.000000
177	0.021065
178	0.696490
179	0.000550
180	0.002529
181	0.005292
182	0.003830
183	0.021065
184	0.001338
185	0.000550
186	0.002529
187	0.005292
188	0.003830
189	0.002403
190	0.001337
191	0.000550
192	0.000280
193	-0.000000
194	0.695939
195	-0.000000
196	0.093795
197	-0.000000

Continua na próxima página

Coordenada y	Valor y
198	-0.013462
199	-0.000000
200	-0.000000
201	-0.000000
202	-0.000000
203	-0.000000
204	-0.000000
205	-0.000000
206	-0.000000
207	-0.000000
208	-0.000000
209	-0.048280
210	1.524615
211	0.000000
212	0.318226
213	-0.000000
214	0.000000
215	-0.048280
216	-0.009794
217	0.000000
218	-0.000000
219	-0.000000
220	0.000000
221	0.000000
222	0.000000
223	0.000000
224	-0.000000
225	-0.000000
226	-0.000000
227	-0.000000
228	-0.000000
229	-0.000000
230	-0.000000
231	-0.000000
232	-0.000000
233	-0.000000
234	-0.000000
235	-0.000000
236	-0.000000
237	-0.000000
238	-0.000000
239	-0.000000
240	-0.000000
241	-0.000000
242	0.135315
243	0.000374
244	0.038346
245	-0.000000
246	0.048527

Continua na próxima página

Coordenada y	Valor y
247	-0.000000
248	0.081409
249	0.000374
250	0.032760
251	-0.000000
252	0.001388
253	0.000333
254	-0.000000
255	0.000374
256	-0.000000
257	-0.000000
258	9.069968
259	4.733381
260	2.577940
261	1.579128
262	0.824359
263	0.631751
264	0.372516
265	0.263508
266	0.154041
267	0.077711
268	0.046500
269	0.027854
270	0.016913
271	0.008336
272	0.011748
273	1.694494
274	0.961411
275	0.555676
276	0.355067
277	0.227274
278	0.148264
279	0.146695
280	0.095460
281	0.058391
282	0.028439
283	0.011644
284	0.006353
285	0.003564
286	0.002003
287	0.001123
288	0.001697
289	1.694258
290	0.963754
291	0.559427
292	0.359510
293	0.229432
294	0.160865
295	0.109336

Continua na próxima página

Coordenada y	Valor y
296	0.082298
297	0.060167
298	0.047657
299	0.040280
300	0.036043
301	0.033719
302	0.026989
303	0.001123
304	0.001697
305	0.623672
306	0.331470
307	0.169739
308	0.089772
309	0.048147
310	0.026206
311	0.014428
312	0.008248
313	0.004707
314	0.002705
315	0.001525
316	0.000847
317	0.000475
318	0.000267
319	0.000150
320	0.000226
321	51.397578
322	29.482452
323	17.352642
324	11.355126
325	8.233248
326	6.587637
327	5.704294
328	5.240791
329	3.912906
330	3.162336
331	2.719715
332	2.117558
333	1.187829
334	-0.000000
335	0.374211
336	0.565596
337	-0.027016
338	-0.015794
339	-0.009243
340	-0.006150
341	-0.000000
342	-0.924440
343	-0.429570
344	-0.000000
Continua na próxima página	

Coordenada y	Valor y
345	-1.706549
346	-1.796367
347	-1.890913
348	-1.990435
349	-2.095195
350	-2.205468
351	-2.321545
352	-2.443732
353	-1.770724
354	-1.010743
355	-0.545494
356	-0.322690
357	-0.182331
358	-0.096620
359	-0.044866
360	-0.022056
361	-0.000000
362	-0.000000
363	-0.000000
364	-0.000000
365	-0.000000
366	-0.000000
367	-0.062855
368	-0.036672
369	-0.021919
370	-0.008100
371	-0.003654
372	-0.002363
373	-0.001503
374	-0.000970
375	-0.000429
376	-0.000564
377	-0.000000
378	-2.171942
379	-0.486086
380	-0.000000
381	-0.000000
382	-0.000000
383	-0.000000
384	-0.000000
385	-0.000000
386	-0.000004
387	-0.000000
388	-0.000000
389	-0.000000
390	-0.000000
391	-0.000000
392	-0.000000
393	-0.000000

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Coordenada y	Valor y
394	-0.000000
395	-1.133086
396	-2.417140
397	-4.743404
398	-4.900077
399	-1.872858
400	-0.459800

## 4 Observações

- O solver HiGHS foi configurado com o método IPM (Interior Point Method).
- Este arquivo contém a solução detalhada para o problema ETAMACRO.
- As variáveis duais representam os multiplicadores de Lagrange das restrições.
- Os custos reduzidos (z) indicam o impacto de forçar variáveis não-básicas na base.