

```
1 C:\Users\Simon\CLionProjects\DRDemo\cmake-build-release\DRDemo.exe
2 Reading file: ../objs/torus.obj
3 Done reading file!
4 Unrecognized token during .obj parsing
5 Unrecognized token during .obj parsing
6 Loaded triangle mesh with 4608 triangles and 2304
   vertices.
7 Unrecognized token during .obj parsing
8 BVH acceleration structure with 2991 nodes, 1496 leafs
   and 4608 shapes.
9 Computing step size...
10 Step size: 0.000134107
11 Iteration: 0
12 Function value: 42883.2
13 Gradient norm: 16708.3
14
15 Computing step size...
16 Step size: 6.57123e-05
17 Iteration: 1
18 Function value: 22127.8
19 Gradient norm: 13415.5
20
21 Computing step size...
22 Step size: 6.57123e-05
23 Iteration: 2
24 Function value: 14524.5
25 Gradient norm: 6701.06
26
27 Computing step size...
28 Step size: 0.000191581
29 Iteration: 3
30 Function value: 12702.2
31 Gradient norm: 3523.04
32
33 Computing step size...
34 Step size: 0.000191581
35 Iteration: 4
36 Function value: 11283.8
37 Gradient norm: 2567.6
38
39 Computing step size...
40 Step size: 9.38748e-05
```

```
41 Iteration: 5
42 Function value: 10533.6
43 Gradient norm: 3308.47
44
45 Computing step size...
46 Step size: 6.57123e-05
47 Iteration: 6
48 Function value: 9910.08
49 Gradient norm: 2913.63
50
51 Computing step size...
52 Step size: 0.000191581
53 Iteration: 7
54 Function value: 9590.96
55 Gradient norm: 2399.57
56
57 Computing step size...
58 Step size: 3.2199e-05
59 Iteration: 8
60 Function value: 8828.77
61 Gradient norm: 3715.66
62
63 Computing step size...
64 Step size: 0.000558546
65 Iteration: 9
66 Function value: 8545.53
67 Gradient norm: 2165.29
68
69 Computing step size...
70 Step size: 4.59986e-05
71 Iteration: 10
72 Function value: 6946.29
73 Gradient norm: 3651.42
74
75 Computing step size...
76 Step size: 4.59986e-05
77 Iteration: 11
78 Function value: 6562.67
79 Gradient norm: 2043.18
80
81 Computing step size...
82 Step size: 6.57123e-05
83 Iteration: 12
```

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84 Function value: 6427.4
85 Gradient norm: 1603.38
86
87 Computing step size...
88 Step size: 4.59986e-05
89 Iteration: 13
90 Function value: 6310.28
91 Gradient norm: 1821.59
92
93 Computing step size...
94 Step size: 3.2199e-05
95 Iteration: 14
96 Function value: 6227.28
97 Gradient norm: 1790.96
98
99 Computing step size...
100 Step size: 9.38748e-05
101 Iteration: 15
102 Function value: 6165.32
103 Gradient norm: 1412.49
104
105 Computing step size...
106 Step size: 1.57775e-05
107 Iteration: 16
108 Function value: 6036.51
109 Gradient norm: 2490.06
110
111 Computing step size...
112 Step size: 0.000134107
113 Iteration: 17
114 Function value: 5983.65
115 Gradient norm: 1316.22
116
117 Computing step size...
118 Step size: 2.25393e-05
119 Iteration: 18
120 Function value: 5861.79
121 Gradient norm: 2303.53
122
123 Computing step size...
124 Step size: 0.000191581
125 Iteration: 19
126 Function value: 5777.97
```

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127 Gradient norm: 1237.63
128
129 Computing step size...
130 Step size: 1.57775e-05
131 Iteration: 20
132 Function value: 5572.38
133 Gradient norm: 2993.72
134
135 Computing step size...
136 Step size: 6.57123e-05
137 Iteration: 21
138 Function value: 5485.89
139 Gradient norm: 1218.74
140
141 Computing step size...
142 Step size: 1.57775e-05
143 Iteration: 22
144 Function value: 5427.08
145 Gradient norm: 1490.02
146
147 Computing step size...
148 Step size: 0.000191581
149 Iteration: 23
150 Function value: 5410.55
151 Gradient norm: 1144.7
152
153 Computing step size...
154 Step size: 5.41169e-06
155 Iteration: 24
156 Function value: 5290.84
157 Gradient norm: 3074.94
158
159 Computing step size...
160 Step size: 3.78818e-06
161 Iteration: 25
162 Function value: 5268.3
163 Gradient norm: 2152.85
164
165 Computing step size...
166 Step size: 3.67033e-08
167 Iteration: 26
168 Function value: 5251.74
169 Gradient norm: 1823.31
```

```
170
171 Starting with additional refinement steps...
172 Computing step size...
173 Step size: 4.67681e-06
174 Iteration: 0
175 Function value: 28789.1
176 Gradient norm: 29125.6
177
178 Computing step size...
179 Step size: 7.30752e-06
180 Iteration: 1
181 Function value: 26769.3
182 Gradient norm: 22840.9
183
184 Computing step size...
185 Step size: 2.39453e-06
186 Iteration: 2
187 Function value: 24395.8
188 Gradient norm: 31155
189
190 Computing step size...
191 Step size: 1.1418e-05
192 Iteration: 3
193 Function value: 23027.3
194 Gradient norm: 19475.8
195
196 Computing step size...
197 Step size: 1.5325e-06
198 Iteration: 4
199 Function value: 20525.5
200 Gradient norm: 45671.7
201
202 Computing step size...
203 Step size: 1.1418e-05
204 Iteration: 5
205 Function value: 18832.6
206 Gradient norm: 17788.4
207
208 Computing step size...
209 Step size: 9.80799e-07
210 Iteration: 6
211 Function value: 16632
212 Gradient norm: 41831.6
```

```
213
214 Computing step size...
215 Step size: 1.42725e-05
216 Iteration: 7
217 Function value: 15634.8
218 Gradient norm: 13901.7
219
220 Computing step size...
221 Step size: 9.80799e-07
222 Iteration: 8
223 Function value: 13985
224 Gradient norm: 41130.3
225
226 Computing step size...
227 Step size: 2.23008e-05
228 Iteration: 9
229 Function value: 13067.4
230 Gradient norm: 12319.9
231
232 Computing step size...
233 Step size: 1.226e-06
234 Iteration: 10
235 Function value: 11112.1
236 Gradient norm: 40506.7
237
238 Computing step size...
239 Step size: 2.99316e-06
240 Iteration: 11
241 Function value: 10066
242 Gradient norm: 12549.9
243
244 Computing step size...
245 Step size: 1.226e-06
246 Iteration: 12
247 Function value: 9793.26
248 Gradient norm: 15805.5
249
250 Computing step size...
251 Step size: 5.84601e-06
252 Iteration: 13
253 Function value: 9610.94
254 Gradient norm: 10393.7
255
```

```
256 Computing step size...
257 Step size: 9.80799e-07
258 Iteration: 14
259 Function value: 9248.64
260 Gradient norm: 21946.4
261
262 Computing step size...
263 Step size: 2.23008e-05
264 Iteration: 15
265 Function value: 8989.15
266 Gradient norm: 9171.49
267
268 Computing step size...
269 Step size: 7.84639e-07
270 Iteration: 16
271 Function value: 7969.96
272 Gradient norm: 37461.8
273
274 Computing step size...
275 Step size: 2.39453e-06
276 Iteration: 17
277 Function value: 7323.4
278 Gradient norm: 10153.9
279
280 Computing step size...
281 Step size: 1.5325e-06
282 Iteration: 18
283 Function value: 7176.2
284 Gradient norm: 10429.4
285
286 Computing step size...
287 Step size: 1.91562e-06
288 Iteration: 19
289 Function value: 7080.21
290 Gradient norm: 8914.64
291
292 Computing step size...
293 Step size: 1.5325e-06
294 Iteration: 20
295 Function value: 6985.98
296 Gradient norm: 9433.99
297
298 Computing step size...
```

```
299 Step size: 1.91562e-06
300 Iteration: 21
301 Function value: 6901.34
302 Gradient norm: 8484.81
303
304 Computing step size...
305 Step size: 1.5325e-06
306 Iteration: 22
307 Function value: 6818.07
308 Gradient norm: 9116.06
309
310 Computing step size...
311 Step size: 2.39453e-06
312 Iteration: 23
313 Function value: 6746.03
314 Gradient norm: 8398.91
315
316 Computing step size...
317 Step size: 1.226e-06
318 Iteration: 24
319 Function value: 6657.29
320 Gradient norm: 10906.5
321
322 Computing step size...
323 Step size: 2.99316e-06
324 Iteration: 25
325 Function value: 6576.16
326 Gradient norm: 7483.56
327
328 Computing step size...
329 Step size: 1.226e-06
330 Iteration: 26
331 Function value: 6477.67
332 Gradient norm: 10688.1
333
334 Computing step size...
335 Step size: 2.99316e-06
336 Iteration: 27
337 Function value: 6403.51
338 Gradient norm: 7291.29
339
340 Computing step size...
341 Step size: 1.226e-06
```

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342 Iteration: 28
343 Function value: 6311.52
344 Gradient norm: 10614.8
345
346 Computing step size...
347 Step size: 2.99316e-06
348 Iteration: 29
349 Function value: 6239.61
350 Gradient norm: 7143.68
351
352 Computing step size...
353 Step size: 9.80799e-07
354 Iteration: 30
355 Function value: 6154.16
356 Gradient norm: 10719.4
357
358 Computing step size...
359 Step size: 1.42725e-05
360 Iteration: 31
361 Function value: 6085.24
362 Gradient norm: 6107.67
363
364 Computing step size...
365 Step size: 7.84639e-07
366 Iteration: 32
367 Function value: 5777.08
368 Gradient norm: 21143.4
369
370 Computing step size...
371 Step size: 1.1418e-05
372 Iteration: 33
373 Function value: 5579.29
374 Gradient norm: 5419.57
375
376 Computing step size...
377 Step size: 7.84639e-07
378 Iteration: 34
379 Function value: 5399.53
380 Gradient norm: 17529.8
381
382 Computing step size...
383 Step size: 7.30752e-06
384 Iteration: 35
```

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385 Function value: 5261.52
386 Gradient norm: 5007.45
387
388 Computing step size...
389 Step size: 9.80799e-07
390 Iteration: 36
391 Function value: 5161.29
392 Gradient norm: 12129.4
393
394 Computing step size...
395 Step size: 4.67681e-06
396 Iteration: 37
397 Function value: 5085.52
398 Gradient norm: 4770.04
399
400 Computing step size...
401 Step size: 9.80799e-07
402 Iteration: 38
403 Function value: 5021.85
404 Gradient norm: 8855.18
405
406 Computing step size...
407 Step size: 7.30752e-06
408 Iteration: 39
409 Function value: 4979.1
410 Gradient norm: 4385.94
411
412 Computing step size...
413 Step size: 7.84639e-07
414 Iteration: 40
415 Function value: 4895.72
416 Gradient norm: 10693.1
417
418 Computing step size...
419 Step size: 2.23008e-05
420 Iteration: 41
421 Function value: 4842.18
422 Gradient norm: 4004.4
423
424 Computing step size...
425 Step size: 7.84639e-07
426 Iteration: 42
427 Function value: 4646.96
```

```
428 Gradient norm: 16965.8
429
430 Computing step size...
431 Step size: 2.99316e-06
432 Iteration: 43
433 Function value: 4517.83
434 Gradient norm: 4452.14
435
436 Computing step size...
437 Step size: 1.91562e-06
438 Iteration: 44
439 Function value: 4481.41
440 Gradient norm: 4766.13
441
442 Computing step size...
443 Step size: 1.5325e-06
444 Iteration: 45
445 Function value: 4457.28
446 Gradient norm: 4739.78
447
448 Computing step size...
449 Step size: 1.91562e-06
450 Iteration: 46
451 Function value: 4439.12
452 Gradient norm: 4160.49
453
454 Computing step size...
455 Step size: 1.5325e-06
456 Iteration: 47
457 Function value: 4421.56
458 Gradient norm: 4586.68
459
460 Computing step size...
461 Step size: 1.5325e-06
462 Iteration: 48
463 Function value: 4404.43
464 Gradient norm: 4115.05
465
466 Computing step size...
467 Step size: 2.39453e-06
468 Iteration: 49
469 Function value: 4388.57
470 Gradient norm: 3772.73
```

```
471
472 Computing step size...
473 Step size: 1.226e-06
474 Iteration: 50
475 Function value: 4368.02
476 Gradient norm: 5001.46
477
478 Computing step size...
479 Step size: 2.99316e-06
480 Iteration: 51
481 Function value: 4351.41
482 Gradient norm: 3500.35
483
484 Computing step size...
485 Step size: 9.80799e-07
486 Iteration: 52
487 Function value: 4331.63
488 Gradient norm: 5409.99
489
490 Computing step size...
491 Step size: 1.1418e-05
492 Iteration: 53
493 Function value: 4314.61
494 Gradient norm: 3028.69
495
496 Computing step size...
497 Step size: 7.84639e-07
498 Iteration: 54
499 Function value: 4250.84
500 Gradient norm: 9516.51
501
502 Computing step size...
503 Step size: 1.42725e-05
504 Iteration: 55
505 Function value: 4210.08
506 Gradient norm: 2800.13
507
508 Computing step size...
509 Step size: 7.84639e-07
510 Iteration: 56
511 Function value: 4146.69
512 Gradient norm: 10117.9
513
```

```
514 Computing step size...
515 Step size: 1.1418e-05
516 Iteration: 57
517 Function value: 4101.72
518 Gradient norm: 2583.67
519
520 Computing step size...
521 Step size: 7.84639e-07
522 Iteration: 58
523 Function value: 4054.31
524 Gradient norm: 7972.61
525
526 Computing step size...
527 Step size: 1.1418e-05
528 Iteration: 59
529 Function value: 4025.05
530 Gradient norm: 2412.25
531
532 Computing step size...
533 Step size: 6.27711e-07
534 Iteration: 60
535 Function value: 3987.64
536 Gradient norm: 7636.2
537
538 Computing step size...
539 Step size: 1.5325e-06
540 Iteration: 61
541 Function value: 3963.38
542 Gradient norm: 2994.78
543
544 Computing step size...
545 Step size: 1.64551e-07
546 Iteration: 62
547 Function value: 3954.97
548 Gradient norm: 2658.4
549
550 Computing step size...
551 Step size: 5.392e-08
552 Iteration: 63
553 Function value: 3953.85
554 Gradient norm: 2497.46
555
556 Computing step size...
```

```
557 Step size: 4.67681e-06
558 Iteration: 0
559 Function value: 18157.7
560 Gradient norm: 12677
561
562 Computing step size...
563 Step size: 1.1418e-05
564 Iteration: 1
565 Function value: 17720.6
566 Gradient norm: 8779.08
567
568 Computing step size...
569 Step size: 3.74145e-06
570 Iteration: 2
571 Function value: 17179.1
572 Gradient norm: 12114.2
573
574 Computing step size...
575 Step size: 3.4845e-05
576 Iteration: 3
577 Function value: 16843.7
578 Gradient norm: 7137.08
579
580 Computing step size...
581 Step size: 2.99316e-06
582 Iteration: 4
583 Function value: 15747.3
584 Gradient norm: 18057.9
585
586 Computing step size...
587 Step size: 8.50707e-05
588 Iteration: 5
589 Function value: 15217.8
590 Gradient norm: 5735.23
591
592 Computing step size...
593 Step size: 2.99316e-06
594 Iteration: 6
595 Function value: 13569.9
596 Gradient norm: 19175.1
597
598 Computing step size...
599 Step size: 1.42725e-05
```

```
600 Iteration: 7
601 Function value: 12964
602 Gradient norm: 4754.52
603
604 Computing step size...
605 Step size: 3.74145e-06
606 Iteration: 8
607 Function value: 12770.3
608 Gradient norm: 7139.94
609
610 Computing step size...
611 Step size: 2.7876e-05
612 Iteration: 9
613 Function value: 12660.3
614 Gradient norm: 4005.13
615
616 Computing step size...
617 Step size: 2.99316e-06
618 Iteration: 10
619 Function value: 12419.5
620 Gradient norm: 10719.6
621
622 Computing step size...
623 Step size: 0.000166154
624 Iteration: 11
625 Function value: 12229
626 Gradient norm: 3570.67
627
628 Computing step size...
629 Step size: 2.99316e-06
630 Iteration: 12
631 Function value: 11021.3
632 Gradient norm: 16496.9
633
634 Computing step size...
635 Step size: 9.1344e-06
636 Iteration: 13
637 Function value: 10564.6
638 Gradient norm: 5323.46
639
640 Computing step size...
641 Step size: 9.1344e-06
642 Iteration: 14
```

```
643 Function value: 10413.1
644 Gradient norm: 3245.27
645
646 Computing step size...
647 Step size: 4.67681e-06
648 Iteration: 15
649 Function value: 10359.1
650 Gradient norm: 4219.93
651
652 Computing step size...
653 Step size: 7.30752e-06
654 Iteration: 16
655 Function value: 10315.7
656 Gradient norm: 3248.07
657
658 Computing step size...
659 Step size: 3.74145e-06
660 Iteration: 17
661 Function value: 10273.9
662 Gradient norm: 3944.18
663
664 Computing step size...
665 Step size: 2.23008e-05
666 Iteration: 18
667 Function value: 10238.4
668 Gradient norm: 2721.81
669
670 Computing step size...
671 Step size: 2.99316e-06
672 Iteration: 19
673 Function value: 10145.2
674 Gradient norm: 6442.68
675
676 Computing step size...
677 Step size: 0.000259615
678 Iteration: 20
679 Function value: 10076.1
680 Gradient norm: 2534.81
681
682 Computing step size...
683 Step size: 2.99316e-06
684 Iteration: 21
685 Function value: 9198.97
```

```
686 Gradient norm: 17714.1
687
688 Computing step size...
689 Step size: 3.74145e-06
690 Iteration: 22
691 Function value: 8647.64
692 Gradient norm: 3952.01
693
694 Computing step size...
695 Step size: 1.1418e-05
696 Iteration: 23
697 Function value: 8613.52
698 Gradient norm: 2428.66
699
700 Computing step size...
701 Step size: 3.74145e-06
702 Iteration: 24
703 Function value: 8574.45
704 Gradient norm: 3662.33
705
706 Computing step size...
707 Step size: 1.1418e-05
708 Iteration: 25
709 Function value: 8546.83
710 Gradient norm: 2260.72
711
712 Computing step size...
713 Step size: 2.99316e-06
714 Iteration: 26
715 Function value: 8513.93
716 Gradient norm: 3689.62
717
718 Computing step size...
719 Step size: 0.000132923
720 Iteration: 27
721 Function value: 8489.31
722 Gradient norm: 2063.49
723
724 Computing step size...
725 Step size: 2.39453e-06
726 Iteration: 28
727 Function value: 8203.6
728 Gradient norm: 11972.1
```

```
729
730 Computing step size...
731 Step size: 5.84601e-06
732 Iteration: 29
733 Function value: 8004
734 Gradient norm: 2791.94
735
736 Computing step size...
737 Step size: 5.84601e-06
738 Iteration: 30
739 Function value: 7977.42
740 Gradient norm: 2581.54
741
742 Computing step size...
743 Step size: 4.67681e-06
744 Iteration: 31
745 Function value: 7957.38
746 Gradient norm: 2663.77
747
748 Computing step size...
749 Step size: 7.30752e-06
750 Iteration: 32
751 Function value: 7938.37
752 Gradient norm: 2294.31
753
754 Computing step size...
755 Step size: 3.74145e-06
756 Iteration: 33
757 Function value: 7917.83
758 Gradient norm: 2911.79
759
760 Computing step size...
761 Step size: 1.1418e-05
762 Iteration: 34
763 Function value: 7899.31
764 Gradient norm: 2019.35
765
766 Computing step size...
767 Step size: 2.99316e-06
768 Iteration: 35
769 Function value: 7871.95
770 Gradient norm: 3368.84
771
```

```
772 Computing step size...
773 Step size: 4.35562e-05
774 Iteration: 36
775 Function value: 7851.57
776 Gradient norm: 1848.27
777
778 Computing step size...
779 Step size: 2.99316e-06
780 Iteration: 37
781 Function value: 7765.1
782 Gradient norm: 5931.81
783
784 Computing step size...
785 Step size: 1.42725e-05
786 Iteration: 38
787 Function value: 7708.84
788 Gradient norm: 2069.34
789
790 Computing step size...
791 Step size: 3.74145e-06
792 Iteration: 39
793 Function value: 7674.57
794 Gradient norm: 3176.57
795
796 Computing step size...
797 Step size: 7.30752e-06
798 Iteration: 40
799 Function value: 7653.44
800 Gradient norm: 2094.6
801
802 Computing step size...
803 Step size: 3.74145e-06
804 Iteration: 41
805 Function value: 7634.84
806 Gradient norm: 2554.16
807
808 Computing step size...
809 Step size: 1.1418e-05
810 Iteration: 42
811 Function value: 7619.52
812 Gradient norm: 1930.61
813
814 Computing step size...
```

```
815 Step size: 2.99316e-06
816 Iteration: 43
817 Function value: 7597.61
818 Gradient norm: 3412.35
819
820 Computing step size...
821 Step size: 3.4845e-05
822 Iteration: 44
823 Function value: 7577.2
824 Gradient norm: 1767.55
825
826 Computing step size...
827 Step size: 2.39453e-06
828 Iteration: 45
829 Function value: 7510.29
830 Gradient norm: 5284.98
831
832 Computing step size...
833 Step size: 2.23008e-05
834 Iteration: 46
835 Function value: 7469.99
836 Gradient norm: 1799.39
837
838 Computing step size...
839 Step size: 2.39453e-06
840 Iteration: 47
841 Function value: 7430.35
842 Gradient norm: 4497.49
843
844 Computing step size...
845 Step size: 6.80565e-05
846 Iteration: 48
847 Function value: 7401.64
848 Gradient norm: 1797.24
849
850 Computing step size...
851 Step size: 2.99316e-06
852 Iteration: 49
853 Function value: 7297.45
854 Gradient norm: 5229.66
855
856 Computing step size...
857 Step size: 2.23008e-05
```

```
858 Iteration: 50
859 Function value: 7249.53
860 Gradient norm: 2272.6
861
862 Computing step size...
863 Step size: 3.74145e-06
864 Iteration: 51
865 Function value: 7180.98
866 Gradient norm: 3539.11
867
868 Computing step size...
869 Step size: 7.30752e-06
870 Iteration: 52
871 Function value: 7154.78
872 Gradient norm: 2048.2
873
874 Computing step size...
875 Step size: 4.67681e-06
876 Iteration: 53
877 Function value: 7136.64
878 Gradient norm: 2301.57
879
880 Computing step size...
881 Step size: 5.84601e-06
882 Iteration: 54
883 Function value: 7122.7
884 Gradient norm: 2015.78
885
886 Computing step size...
887 Step size: 5.84601e-06
888 Iteration: 55
889 Function value: 7108.77
890 Gradient norm: 2136.74
891
892 Computing step size...
893 Step size: 4.67681e-06
894 Iteration: 56
895 Function value: 7093.82
896 Gradient norm: 2317.21
897
898 Computing step size...
899 Step size: 5.84601e-06
900 Iteration: 57
```

```
901 Function value: 7080.82
902 Gradient norm: 2043.74
903
904 Computing step size...
905 Step size: 4.67681e-06
906 Iteration: 58
907 Function value: 7067
908 Gradient norm: 2222.2
909
910 Computing step size...
911 Step size: 5.84601e-06
912 Iteration: 59
913 Function value: 7054.13
914 Gradient norm: 1997.58
915
916 Computing step size...
917 Step size: 4.67681e-06
918 Iteration: 60
919 Function value: 7041.46
920 Gradient norm: 2198.82
921
922 Computing step size...
923 Step size: 5.84601e-06
924 Iteration: 61
925 Function value: 7029.22
926 Gradient norm: 1994.53
927
928 Computing step size...
929 Step size: 4.67681e-06
930 Iteration: 62
931 Function value: 7015.89
932 Gradient norm: 2212.91
933
934 Computing step size...
935 Step size: 5.84601e-06
936 Iteration: 63
937 Function value: 7004.08
938 Gradient norm: 2004.73
939
940 Computing step size...
941 Step size: 4.67681e-06
942 Iteration: 64
943 Function value: 6991.31
```

```
944 Gradient norm: 2231.76
945
946 Computing step size...
947 Step size: 4.67681e-06
948 Iteration: 65
949 Function value: 6979.12
950 Gradient norm: 2014.52
951
952 Computing step size...
953 Step size: 7.30752e-06
954 Iteration: 66
955 Function value: 6967.49
956 Gradient norm: 1859.34
957
958 Computing step size...
959 Step size: 3.74145e-06
960 Iteration: 67
961 Function value: 6953.87
962 Gradient norm: 2439.24
963
964 Computing step size...
965 Step size: 9.1344e-06
966 Iteration: 68
967 Function value: 6941.38
968 Gradient norm: 1729.64
969
970 Computing step size...
971 Step size: 3.74145e-06
972 Iteration: 69
973 Function value: 6925.72
974 Gradient norm: 2553.12
975
976 Computing step size...
977 Step size: 9.1344e-06
978 Iteration: 70
979 Function value: 6912.79
980 Gradient norm: 1764.99
981
982 Computing step size...
983 Step size: 2.99316e-06
984 Iteration: 71
985 Function value: 6898.14
986 Gradient norm: 2724.18
```

```
987
988 Computing step size...
989 Step size: 5.44452e-05
990 Iteration: 72
991 Function value: 6884.35
992 Gradient norm: 1547.48
993
994 Computing step size...
995 Step size: 2.39453e-06
996 Iteration: 73
997 Function value: 6817.87
998 Gradient norm: 6321.9
999
1000 Computing step size...
1001 Step size: 1.1418e-05
1002 Iteration: 74
1003 Function value: 6761.48
1004 Gradient norm: 1737.02
1005
1006 Computing step size...
1007 Step size: 2.99316e-06
1008 Iteration: 75
1009 Function value: 6742.35
1010 Gradient norm: 2933.67
1011
1012 Computing step size...
1013 Step size: 2.23008e-05
1014 Iteration: 76
1015 Function value: 6728.05
1016 Gradient norm: 1552.04
1017
1018 Computing step size...
1019 Step size: 2.99316e-06
1020 Iteration: 77
1021 Function value: 6697.97
1022 Gradient norm: 3754.1
1023
1024 Computing step size...
1025 Step size: 1.78406e-05
1026 Iteration: 78
1027 Function value: 6675.99
1028 Gradient norm: 1594.47
1029
```

```
1030 Computing step size...
1031 Step size: 2.99316e-06
1032 Iteration: 79
1033 Function value: 6649.84
1034 Gradient norm: 3174.05
1035
1036 Computing step size...
1037 Step size: 1.78406e-05
1038 Iteration: 80
1039 Function value: 6633.16
1040 Gradient norm: 1599.29
1041
1042 Computing step size...
1043 Step size: 2.99316e-06
1044 Iteration: 81
1045 Function value: 6608.43
1046 Gradient norm: 3161.08
1047
1048 Computing step size...
1049 Step size: 2.23008e-05
1050 Iteration: 82
1051 Function value: 6591.03
1052 Gradient norm: 1576.83
1053
1054 Computing step size...
1055 Step size: 3.74145e-06
1056 Iteration: 83
1057 Function value: 6558.06
1058 Gradient norm: 3059.86
1059
1060 Computing step size...
1061 Step size: 5.84601e-06
1062 Iteration: 84
1063 Function value: 6539.74
1064 Gradient norm: 1845.34
1065
1066 Computing step size...
1067 Step size: 4.67681e-06
1068 Iteration: 85
1069 Function value: 6528.09
1070 Gradient norm: 1930.23
1071
1072 Computing step size...
```

```
1073 Step size: 5.84601e-06
1074 Iteration: 86
1075 Function value: 6518.51
1076 Gradient norm: 1748.21
1077
1078 Computing step size...
1079 Step size: 4.67681e-06
1080 Iteration: 87
1081 Function value: 6507.66
1082 Gradient norm: 1910.02
1083
1084 Computing step size...
1085 Step size: 5.84601e-06
1086 Iteration: 88
1087 Function value: 6498.12
1088 Gradient norm: 1739.94
1089
1090 Computing step size...
1091 Step size: 4.67681e-06
1092 Iteration: 89
1093 Function value: 6487.66
1094 Gradient norm: 1901.81
1095
1096 Computing step size...
1097 Step size: 5.84601e-06
1098 Iteration: 90
1099 Function value: 6478.95
1100 Gradient norm: 1737.29
1101
1102 Computing step size...
1103 Step size: 3.74145e-06
1104 Iteration: 91
1105 Function value: 6468.26
1106 Gradient norm: 1901.24
1107
1108 Computing step size...
1109 Step size: 1.42725e-05
1110 Iteration: 92
1111 Function value: 6460.36
1112 Gradient norm: 1507.83
1113
1114 Computing step size...
1115 Step size: 2.99316e-06
```

```
1116 Iteration: 93
1117 Function value: 6441.36
1118 Gradient norm: 2941.57
1119
1120 Computing step size...
1121 Step size: 2.7876e-05
1122 Iteration: 94
1123 Function value: 6426.95
1124 Gradient norm: 1448.77
1125
1126 Computing step size...
1127 Step size: 2.39453e-06
1128 Iteration: 95
1129 Function value: 6395.53
1130 Gradient norm: 4229.79
1131
1132 Computing step size...
1133 Step size: 5.44452e-05
1134 Iteration: 96
1135 Function value: 6370.94
1136 Gradient norm: 1406.77
1137
1138 Computing step size...
1139 Step size: 2.39453e-06
1140 Iteration: 97
1141 Function value: 6312.6
1142 Gradient norm: 5271.54
1143
1144 Computing step size...
1145 Step size: 9.1344e-06
1146 Iteration: 98
1147 Function value: 6271.71
1148 Gradient norm: 1677.74
1149
1150 Computing step size...
1151 Step size: 3.74145e-06
1152 Iteration: 99
1153 Function value: 6255.25
1154 Gradient norm: 2153.85
1155
1156 Computing step size...
1157 Step size: 0.000166154
1158 Iteration: 0
```

```
1159 Function value: 51621.9
1160 Gradient norm: 8036.76
1161
1162 Computing step size...
1163 Step size: 3.4845e-05
1164 Iteration: 1
1165 Function value: 46366.8
1166 Gradient norm: 9424.39
1167
1168 Computing step size...
1169 Step size: 6.80565e-05
1170 Iteration: 2
1171 Function value: 44858.2
1172 Gradient norm: 6654.45
1173
1174 Computing step size...
1175 Step size: 5.44452e-05
1176 Iteration: 3
1177 Function value: 43421
1178 Gradient norm: 7403.14
1179
1180 Computing step size...
1181 Step size: 0.000106338
1182 Iteration: 4
1183 Function value: 41993.9
1184 Gradient norm: 5351.62
1185
1186 Computing step size...
1187 Step size: 5.44452e-05
1188 Iteration: 5
1189 Function value: 40058.3
1190 Gradient norm: 5916.52
1191
1192 Computing step size...
1193 Step size: 0.000132923
1194 Iteration: 6
1195 Function value: 39040.9
1196 Gradient norm: 4319.01
1197
1198 Computing step size...
1199 Step size: 9.1344e-06
1200 Iteration: 7
1201 Function value: 37369.8
```

```
1202 Gradient norm: 9874.47
1203
1204 Computing step size...
1205 Step size: 0.000259615
1206 Iteration: 8
1207 Function value: 36939.5
1208 Gradient norm: 3993.1
1209
1210 Computing step size...
1211 Step size: 1.78406e-05
1212 Iteration: 9
1213 Function value: 34813.6
1214 Gradient norm: 10773.3
1215
1216 Computing step size...
1217 Step size: 5.44452e-05
1218 Iteration: 10
1219 Function value: 33742.4
1220 Gradient norm: 4428.31
1221
1222 Computing step size...
1223 Step size: 1.78406e-05
1224 Iteration: 11
1225 Function value: 33058.7
1226 Gradient norm: 5514.96
1227
1228 Computing step size...
1229 Step size: 0.000132923
1230 Iteration: 12
1231 Function value: 32800.4
1232 Gradient norm: 3413.8
1233
1234 Computing step size...
1235 Step size: 7.30752e-06
1236 Iteration: 13
1237 Function value: 31825.8
1238 Gradient norm: 10528.3
1239
1240 Computing step size...
1241 Step size: 5.44452e-05
1242 Iteration: 14
1243 Function value: 31392.7
1244 Gradient norm: 3720.63
```

```
1245
1246 Computing step size...
1247 Step size: 5.44452e-05
1248 Iteration: 15
1249 Function value: 30981.9
1250 Gradient norm: 3979.23
1251
1252 Computing step size...
1253 Step size: 2.23008e-05
1254 Iteration: 16
1255 Function value: 30519.7
1256 Gradient norm: 4888.84
1257
1258 Computing step size...
1259 Step size: 6.80565e-05
1260 Iteration: 17
1261 Function value: 30272.5
1262 Gradient norm: 3284.74
1263
1264 Computing step size...
1265 Step size: 9.1344e-06
1266 Iteration: 18
1267 Function value: 29812.4
1268 Gradient norm: 6383.25
1269
1270 Computing step size...
1271 Step size: 0.000207692
1272 Iteration: 19
1273 Function value: 29619.4
1274 Gradient norm: 2992.5
1275
1276 Computing step size...
1277 Step size: 1.1418e-05
1278 Iteration: 20
1279 Function value: 28510.8
1280 Gradient norm: 8002.63
1281
1282 Computing step size...
1283 Step size: 2.7876e-05
1284 Iteration: 21
1285 Function value: 28120.9
1286 Gradient norm: 4099.05
1287
```

```
1288 Computing step size...
1289 Step size: 1.1418e-05
1290 Iteration: 22
1291 Function value: 27845.2
1292 Gradient norm: 4591.41
1293
1294 Computing step size...
1295 Step size: 4.35562e-05
1296 Iteration: 23
1297 Function value: 27717.3
1298 Gradient norm: 2980.35
1299
1300 Computing step size...
1301 Step size: 9.1344e-06
1302 Iteration: 24
1303 Function value: 27488
1304 Gradient norm: 5409.48
1305
1306 Computing step size...
1307 Step size: 0.000106338
1308 Iteration: 25
1309 Function value: 27347.8
1310 Gradient norm: 2701.14
1311
1312 Computing step size...
1313 Step size: 5.84601e-06
1314 Iteration: 26
1315 Function value: 26919.1
1316 Gradient norm: 9201.39
1317
1318 Computing step size...
1319 Step size: 3.4845e-05
1320 Iteration: 27
1321 Function value: 26632.6
1322 Gradient norm: 3063.34
1323
1324 Computing step size...
1325 Step size: 2.7876e-05
1326 Iteration: 28
1327 Function value: 26462.3
1328 Gradient norm: 3454.23
1329
1330 Computing step size...
```

```
1331 Step size: 1.42725e-05
1332 Iteration: 29
1333 Function value: 26274.8
1334 Gradient norm: 3755.99
1335
1336 Computing step size...
1337 Step size: 4.35562e-05
1338 Iteration: 30
1339 Function value: 26164.9
1340 Gradient norm: 2721.65
1341
1342 Computing step size...
1343 Step size: 1.1418e-05
1344 Iteration: 31
1345 Function value: 25975.1
1346 Gradient norm: 4740.38
1347
1348 Computing step size...
1349 Step size: 5.44452e-05
1350 Iteration: 32
1351 Function value: 25845.6
1352 Gradient norm: 2616.3
1353
1354 Computing step size...
1355 Step size: 9.1344e-06
1356 Iteration: 33
1357 Function value: 25613.8
1358 Gradient norm: 5253.13
1359
1360 Computing step size...
1361 Step size: 8.50707e-05
1362 Iteration: 34
1363 Function value: 25475.8
1364 Gradient norm: 2518.91
1365
1366 Computing step size...
1367 Step size: 7.30752e-06
1368 Iteration: 35
1369 Function value: 25160.7
1370 Gradient norm: 6306.97
1371
1372 Computing step size...
1373 Step size: 6.80565e-05
```

```
1374 Iteration: 36
1375 Function value: 24995.1
1376 Gradient norm: 2654.27
1377
1378 Computing step size...
1379 Step size: 1.1418e-05
1380 Iteration: 37
1381 Function value: 24742
1382 Gradient norm: 4855.87
1383
1384 Computing step size...
1385 Step size: 2.7876e-05
1386 Iteration: 38
1387 Function value: 24592.1
1388 Gradient norm: 2828.82
1389
1390 Computing step size...
1391 Step size: 1.1418e-05
1392 Iteration: 39
1393 Function value: 24455.8
1394 Gradient norm: 3712.39
1395
1396 Computing step size...
1397 Step size: 3.4845e-05
1398 Iteration: 40
1399 Function value: 24374.6
1400 Gradient norm: 2597.67
1401
1402 Computing step size...
1403 Step size: 9.1344e-06
1404 Iteration: 41
1405 Function value: 24245.2
1406 Gradient norm: 4566.06
1407
1408 Computing step size...
1409 Step size: 5.44452e-05
1410 Iteration: 42
1411 Function value: 24147.9
1412 Gradient norm: 2402.29
1413
1414 Computing step size...
1415 Step size: 7.30752e-06
1416 Iteration: 43
```

```
1417 Function value: 23953.8
1418 Gradient norm: 5165.78
1419
1420 Computing step size...
1421 Step size: 0.000132923
1422 Iteration: 44
1423 Function value: 23840.8
1424 Gradient norm: 2330.67
1425
1426 Computing step size...
1427 Step size: 7.30752e-06
1428 Iteration: 45
1429 Function value: 23455.7
1430 Gradient norm: 7682.99
1431
1432 Computing step size...
1433 Step size: 2.23008e-05
1434 Iteration: 46
1435 Function value: 23224.3
1436 Gradient norm: 3151.67
1437
1438 Computing step size...
1439 Step size: 1.1418e-05
1440 Iteration: 47
1441 Function value: 23105.9
1442 Gradient norm: 3380.79
1443
1444 Computing step size...
1445 Step size: 2.23008e-05
1446 Iteration: 48
1447 Function value: 23036.8
1448 Gradient norm: 2572.92
1449
1450 Computing step size...
1451 Step size: 9.1344e-06
1452 Iteration: 49
1453 Function value: 22953.7
1454 Gradient norm: 3618.54
1455
1456 Computing step size...
1457 Step size: 2.7876e-05
1458 Iteration: 50
1459 Function value: 22888.7
```

```
1460 Gradient norm: 2391.88
1461
1462 Computing step size...
1463 Step size: 9.1344e-06
1464 Iteration: 51
1465 Function value: 22797.8
1466 Gradient norm: 3839.11
1467
1468 Computing step size...
1469 Step size: 2.7876e-05
1470 Iteration: 52
1471 Function value: 22726
1472 Gradient norm: 2358.25
1473
1474 Computing step size...
1475 Step size: 9.1344e-06
1476 Iteration: 53
1477 Function value: 22640
1478 Gradient norm: 3713.19
1479
1480 Computing step size...
1481 Step size: 2.7876e-05
1482 Iteration: 54
1483 Function value: 22573.5
1484 Gradient norm: 2322.96
1485
1486 Computing step size...
1487 Step size: 9.1344e-06
1488 Iteration: 55
1489 Function value: 22485.8
1490 Gradient norm: 3589.87
1491
1492 Computing step size...
1493 Step size: 3.4845e-05
1494 Iteration: 56
1495 Function value: 22420.9
1496 Gradient norm: 2307.25
1497
1498 Computing step size...
1499 Step size: 7.30752e-06
1500 Iteration: 57
1501 Function value: 22327.4
1502 Gradient norm: 4352.11
```

```
1503
1504 Computing step size...
1505 Step size: 0.000106338
1506 Iteration: 58
1507 Function value: 22245.2
1508 Gradient norm: 2158.87
1509
1510 Computing step size...
1511 Step size: 5.84601e-06
1512 Iteration: 59
1513 Function value: 21993.5
1514 Gradient norm: 6890.17
1515
1516 Computing step size...
1517 Step size: 2.7876e-05
1518 Iteration: 60
1519 Function value: 21829.9
1520 Gradient norm: 2639.33
1521
1522 Computing step size...
1523 Step size: 1.78406e-05
1524 Iteration: 61
1525 Function value: 21732.1
1526 Gradient norm: 2936.41
1527
1528 Computing step size...
1529 Step size: 1.42725e-05
1530 Iteration: 62
1531 Function value: 21649.6
1532 Gradient norm: 2776.11
1533
1534 Computing step size...
1535 Step size: 1.78406e-05
1536 Iteration: 63
1537 Function value: 21591.3
1538 Gradient norm: 2463.1
1539
1540 Computing step size...
1541 Step size: 1.1418e-05
1542 Iteration: 64
1543 Function value: 21525.4
1544 Gradient norm: 2840.66
1545
```

```
1546 Computing step size...
1547 Step size: 2.23008e-05
1548 Iteration: 65
1549 Function value: 21476.2
1550 Gradient norm: 2354.82
1551
1552 Computing step size...
1553 Step size: 9.1344e-06
1554 Iteration: 66
1555 Function value: 21409.1
1556 Gradient norm: 3294.16
1557
1558 Computing step size...
1559 Step size: 2.7876e-05
1560 Iteration: 67
1561 Function value: 21352.2
1562 Gradient norm: 2200.33
1563
1564 Computing step size...
1565 Step size: 9.1344e-06
1566 Iteration: 68
1567 Function value: 21276.1
1568 Gradient norm: 3511.9
1569
1570 Computing step size...
1571 Step size: 2.7876e-05
1572 Iteration: 69
1573 Function value: 21216
1574 Gradient norm: 2203.13
1575
1576 Computing step size...
1577 Step size: 9.1344e-06
1578 Iteration: 70
1579 Function value: 21139.1
1580 Gradient norm: 3553.51
1581
1582 Computing step size...
1583 Step size: 2.7876e-05
1584 Iteration: 71
1585 Function value: 21075.4
1586 Gradient norm: 2187.98
1587
1588 Computing step size...
```

```
1589 Step size: 7.30752e-06
1590 Iteration: 72
1591 Function value: 20998.6
1592 Gradient norm: 3593.72
1593
1594 Computing step size...
1595 Step size: 8.50707e-05
1596 Iteration: 73
1597 Function value: 20944.1
1598 Gradient norm: 2018.74
1599
1600 Computing step size...
1601 Step size: 5.84601e-06
1602 Iteration: 74
1603 Function value: 20750.6
1604 Gradient norm: 5814.02
1605
1606 Computing step size...
1607 Step size: 4.35562e-05
1608 Iteration: 75
1609 Function value: 20635.4
1610 Gradient norm: 2204.91
1611
1612 Computing step size...
1613 Step size: 1.42725e-05
1614 Iteration: 76
1615 Function value: 20529
1616 Gradient norm: 3321.16
1617
1618 Computing step size...
1619 Step size: 1.42725e-05
1620 Iteration: 77
1621 Function value: 20442.1
1622 Gradient norm: 2563.23
1623
1624 Computing step size...
1625 Step size: 1.42725e-05
1626 Iteration: 78
1627 Function value: 20391.7
1628 Gradient norm: 2501.07
1629
1630 Computing step size...
1631 Step size: 1.42725e-05
```

```
1632 Iteration: 79
1633 Function value: 20341.4
1634 Gradient norm: 2478.28
1635
1636 Computing step size...
1637 Step size: 1.42725e-05
1638 Iteration: 80
1639 Function value: 20294.8
1640 Gradient norm: 2471.3
1641
1642 Computing step size...
1643 Step size: 1.42725e-05
1644 Iteration: 81
1645 Function value: 20247.2
1646 Gradient norm: 2473.31
1647
1648 Computing step size...
1649 Step size: 1.42725e-05
1650 Iteration: 82
1651 Function value: 20199.4
1652 Gradient norm: 2427.15
1653
1654 Computing step size...
1655 Step size: 1.42725e-05
1656 Iteration: 83
1657 Function value: 20152.5
1658 Gradient norm: 2414.81
1659
1660 Computing step size...
1661 Step size: 1.42725e-05
1662 Iteration: 84
1663 Function value: 20106.8
1664 Gradient norm: 2408.42
1665
1666 Computing step size...
1667 Step size: 1.42725e-05
1668 Iteration: 85
1669 Function value: 20056.7
1670 Gradient norm: 2401.98
1671
1672 Computing step size...
1673 Step size: 1.42725e-05
1674 Iteration: 86
```

```
1675 Function value: 20008.3
1676 Gradient norm: 2392.36
1677
1678 Computing step size...
1679 Step size: 1.42725e-05
1680 Iteration: 87
1681 Function value: 19962.3
1682 Gradient norm: 2392.42
1683
1684 Computing step size...
1685 Step size: 1.42725e-05
1686 Iteration: 88
1687 Function value: 19916
1688 Gradient norm: 2393.48
1689
1690 Computing step size...
1691 Step size: 1.42725e-05
1692 Iteration: 89
1693 Function value: 19867.3
1694 Gradient norm: 2382.68
1695
1696 Computing step size...
1697 Step size: 1.42725e-05
1698 Iteration: 90
1699 Function value: 19822.8
1700 Gradient norm: 2384.03
1701
1702 Computing step size...
1703 Step size: 1.42725e-05
1704 Iteration: 91
1705 Function value: 19774.6
1706 Gradient norm: 2381.12
1707
1708 Computing step size...
1709 Step size: 1.42725e-05
1710 Iteration: 92
1711 Function value: 19729.6
1712 Gradient norm: 2392.11
1713
1714 Computing step size...
1715 Step size: 1.42725e-05
1716 Iteration: 93
1717 Function value: 19687.6
```

```
1718 Gradient norm: 2384.38
1719
1720 Computing step size...
1721 Step size: 1.42725e-05
1722 Iteration: 94
1723 Function value: 19643.9
1724 Gradient norm: 2375.32
1725
1726 Computing step size...
1727 Step size: 1.42725e-05
1728 Iteration: 95
1729 Function value: 19597.9
1730 Gradient norm: 2359.32
1731
1732 Computing step size...
1733 Step size: 1.42725e-05
1734 Iteration: 96
1735 Function value: 19552.3
1736 Gradient norm: 2380.24
1737
1738 Computing step size...
1739 Step size: 1.42725e-05
1740 Iteration: 97
1741 Function value: 19507.7
1742 Gradient norm: 2352.25
1743
1744 Computing step size...
1745 Step size: 1.42725e-05
1746 Iteration: 98
1747 Function value: 19468.3
1748 Gradient norm: 2324.9
1749
1750 Computing step size...
1751 Step size: 1.42725e-05
1752 Iteration: 99
1753 Function value: 19427.9
1754 Gradient norm: 2325.4
1755
1756
1757 Process finished with exit code 0
1758
```