Lautsch Finite Elemente GmbH

# **The Blue Crab**

### SIAM IMR24: Meshing Contest

The IMR Committee is pleased to announce that the Meshing Contest will again be part of the SIAM International Meshing Roundtable Workshop 2024, Mar. 5-8, 2023.

#### Contest

Participants can submit entries demonstrating the capabilities of their software in the following disciplines:

- mesh generation
- · mesh post-processing



1

22.10.2023





The MMT mesh ( left column ) is a refinement of an adapted multigrid mesh ( right column ).

The right column contains repeated BCC refinements. All tetras shown are hit by the crab geometry.

MT-Refinement works for any mesh. Either it works geometrically correct or incorrect.

## Adaptive Multigrid refinement strategy:

Refine edges, triangles, tetras where MT works geometrically incorrect.

Terminate when all MT-refinements are geometrically correct the maximum number of refinements is reached

Lautsch Finite Elemente



Resolution 160 mm 406 Tetras



Lautsch Finite Elemente



Resolution 40 mm 6278 Tetras



Resolution 20 mm 25 252 Tetras



Resolution 10 mm 88 737 Tetras



Resolution 5 mm 309 502 Tetras



Resolution 2.5 mm 1 078 750 Tetras



Input

#### Resolution 2.5 mm 1 078 750 Tetras

Resolution 1.25 mm 3 719 921 Tetras



Input .obj data were automaticlly translated to STL data 150 000 triangles no free edges no Tjoint edges one connected component

Is topologically correct and simple, more simple and correct than the 2023 IMR meshing contest windmill.

Lautsch Finite Elemente GmbH zeno Multigrid Marching Tetra + + + + 2023 + + DVLP 8.5 FR memory available on this computer 25 GB mem\_avail input file BC.mmt read stl /home/lfe/Modelle/blue-crab/blue-crab-150k.stl distinct nodes 74974 triangles 150000 anz m0 octree 784 read zeno input part 1 /home/lfe/Modelle/blue-crab/blue-crab-150k.stl ead\_zeno\_input RESOLUTION 5.000000 read\_zeno\_input FLUID MESH 1 + fluid number of parts units as for node coordinates RESOLUTION 5.000 REFINE 4 40 20 4 all edges - max equal split ref - ref per level - max unequal split ref - default 4 40 20 4 WORST BARYC 0.01000 lower barycentric boundary for new node position - default 0.01 FEATURE 20.0 sharp edges - degree - default 20.0 FIRST TET 1.57 0.78 1.10 rota rota enlarge default 1.57 0.78 1.10 ERY BAD 1.0e-04 bad tetra IMPROVE default 1.e-4 IMPROVE default off APPROX MESH default off / MIDNODES default off / FLUID MESH default off % edge refine | av quality | % TET quality <= 0.0500 | worst TET shortest edge | Tetras min max level initial mesh 0.0 0.707 0.00 0.70711 4.82e+02 1 0 0 1 1 octree 0.0 0.707 0.00 0.70711 2.41e+02 8 2 octree 0.0 0.707 1.21e+02 0.00 0.70711 64 octree 0.0 0.707 0.00 0.70711 6.03e+01 512 3 octree 0.0 0.707 0.00 0.70711 3.01e+01 4096 4 4 0.597 1.51e+01 6308 4 octree 0.0 0.00 0.15506 5 17256 octree 0.0 0.516 0.00 0.15506 7.53e+00 б 4 octree 0.0 0.479 0.00 0.15506 3.77e+00 61151 7 octree 0.0 0.452 0.00 0.15506 1.88e+00 239642 4 8 -- some more edges to refine, but no edges to refine > RESOLUTION = 5.000000 Marching Tet A 99.9 266659 9 0.415 3.66 2.64e-05 1.12e-02 4 Marching Tet B 88.8 0.209 26.87 1.88e-07 7.53e-04 709981 4 10 solid volume 28.55 6 10 0.186 1.01e-06 7.53e-04 309502 % node coarsen | av quality | % TET quality <= 0.0500 |</pre> worst TET shortest edge | Tetras | min max level 1.009e-06 worst solid TET 82162 179781 204154 205116 10 124850 82162 124607 123953 9 1.609e-03 ->parent ->parent 82154 104672 82162 99460 8 2.722e-01 ->parent 78927 80032 82154 82162 7.071e-01 6 ->parent 76074 76812 76813 77329 7.071e-01 76293 76072 76073 76074 ->parent 7.071e-01 75793 75237 75658 75370 4 7.071e-01 ->parent ->parent 75009 75121 75058 75125 3 7.071e-01 ->parent 74982 75000 75009 75001 7.071e-01 74979 74980 74982 74983 7.071e-01 ->parent 1 ->parent 74975 74976 74977 74978 0 7.071e-01 worst solid TET, shortest edge 179781 204154 overall time 333 sec allocated memory 25.0 GB memory used 8.2 8.1 6.5 6.1 5.2 % m0 m1 m2 m3 geocut write mesh AA write mesh number of imprints 1 write\_mesh\_nastran A aktuell = 600 Lautsch Finite Elemente GmbH zeno Multigrid Marching Tetra + + + + 2023 + + DVLP 8.5 FR

Lautsch Finite Elemente