Exploring meshes

pMesh

Playing with mesh creation. Notice that the functions calls are in pGrid and pTGrid. The others are only for arrange the data. Try to change uo and vo.

Targets are 3:
1. For visualization, get the best view with less matrix size.
2. For solving PDE's, get the best mesh for the algorithm.
3. For the 3D printer, get the faster path for the printer head.

peaks

$$peaks(x, y) := 3 \cdot \frac{(1-x)^2}{e^{x^2+(y+1)^2}} - 10 \cdot \frac{\frac{x}{5} - x^3 - y^5}{e^{x^2+y^2}} - \frac{1}{3 \cdot e^{(x+1)^2+y^2}}$$

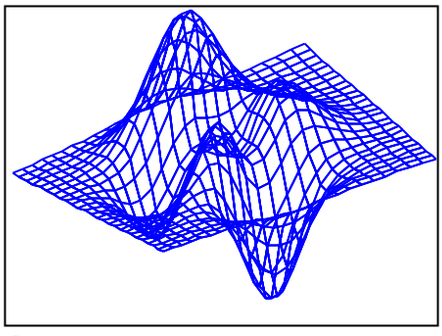
$$U := pR(-3, 3, 25)$$
$$V := pR(-3, 3, 25)$$
$$G := pGrid(peaks, U, V)$$
$$z := [3\ 2\ 1]$$

pMesh

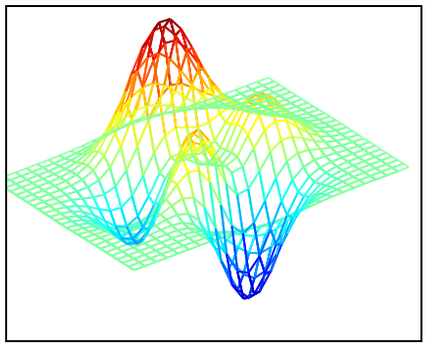
$$uo := [0\ 0\ 1\ 1\ 0]$$
$$vo := [0\ 1\ 1\ 0\ 0]$$
$$S := pMesh(G, uo, vo)$$
$$S_1 := pZoom(S, z)$$

$\text{rows}(S_1) = 3725$

Viacheslav original mesh



$S_1 \cdot Y$

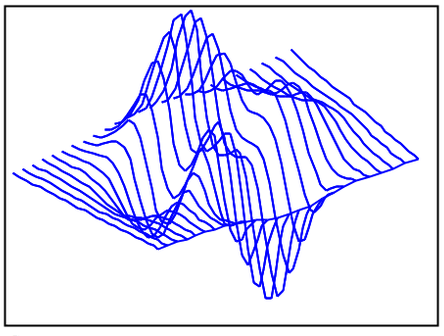


$pMeshShow(S_1, CM, Y)$

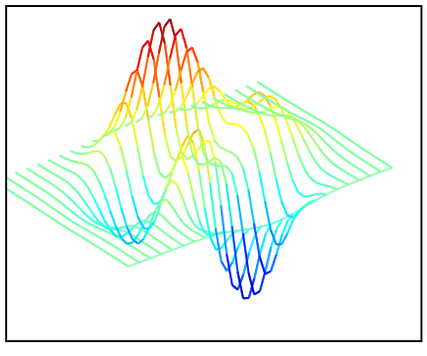
$$uo := [0\ 0]$$
$$vo := [1\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_2 := pZoom(S, z)$$

$\text{rows}(S_2) = 1850$

waterfall along x



$S_2 \cdot Y$

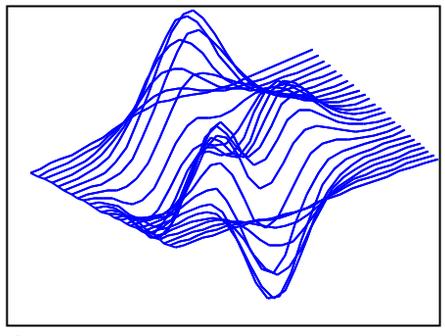


$pMeshShow(S_2, CM, Y)$

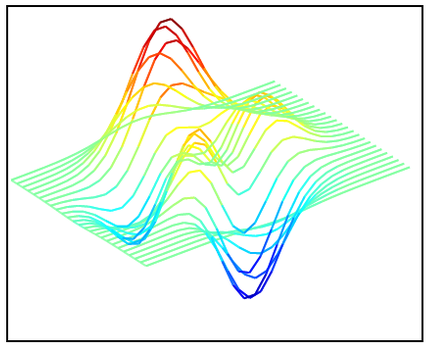
$$uo := [0\ 0]$$
$$vo := [1\ 1]$$
$$S := pMesh(G^T, uo, vo)$$
$$S_3 := pZoom(S, z)$$

$\text{rows}(S_3) = 1850$

waterfall along y



$S_3 \cdot Y$



$pMeshShow(S_3, CM, Y)$

$$uo := [1\ 0]$$
$$vo := [0\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_1 := pZoom(S, z)$$

$\text{rows}(S_1) = 1850$

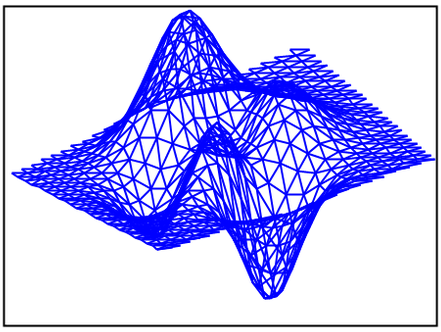
$$uo := [0\ 0\ 1]$$
$$vo := [0\ 1\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_2 := pZoom(S, z)$$

$\text{rows}(S_2) = 2475$

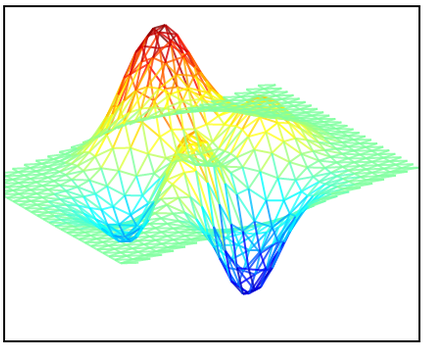
$$uo := [0\ 0\ 1\ 0\ 1]$$
$$vo := [0\ 1\ 1\ 0\ 0]$$
$$S := pMesh(G, uo, vo)$$
$$S_3 := pZoom(S, z)$$

$\text{rows}(S_3) = 3725$

fake but fast trimesh

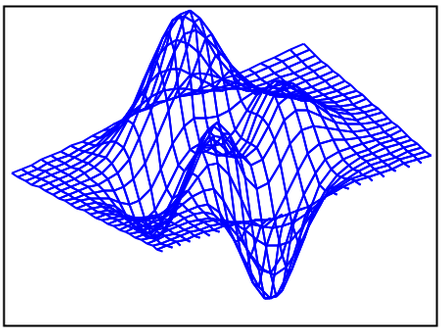


$S_1 \cdot Y$

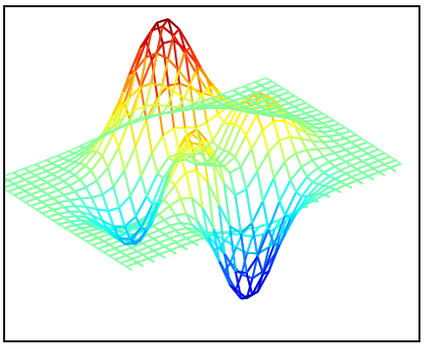


$pMeshShow\left(S_1, CM, Y\right)$

something else

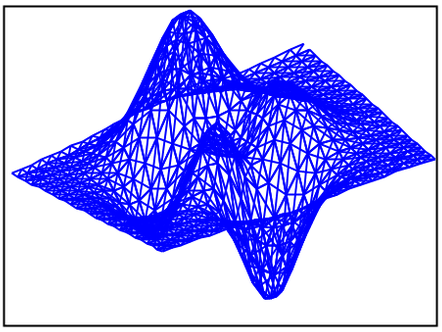


$S_2 \cdot Y$

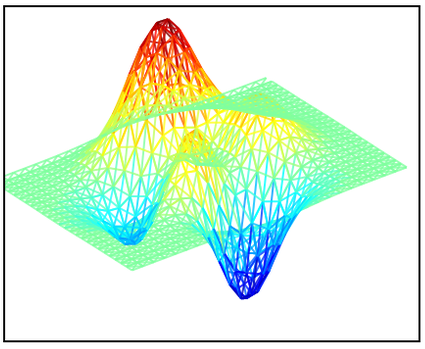


$pMeshShow\left(S_2, CM, Y\right)$

fake but nice trimesh



$S_3 \cdot Y$



$pMeshShow\left(S_3, CM, Y\right)$

Trimesh

Trimesh

$TG := pTGrid\left(peaks, U, V\right)$

$uo := [\,0\ 0\ 1\ 0\ 1\,]$
$vo := [\,0\ 1\ 1\ 0\ 0\,]$
$S := pTMesh\left(G, TG, uo, vo\right)$
$S_1 := pZoom\left(S, z\right)$

$\text{rows}\left(S_1\right) = 4525$

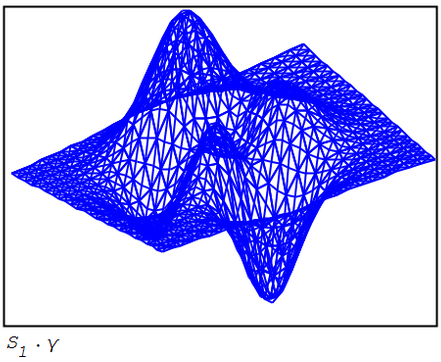
$uo := [\,0\ 1\ 0\,]$
$vo := [\,0\ 1\ 1\,]$
$S := pTMesh\left(G, TG, uo, vo\right)$
$S_2 := pZoom\left(S, z\right)$

$\text{rows}\left(S_2\right) = 3225$

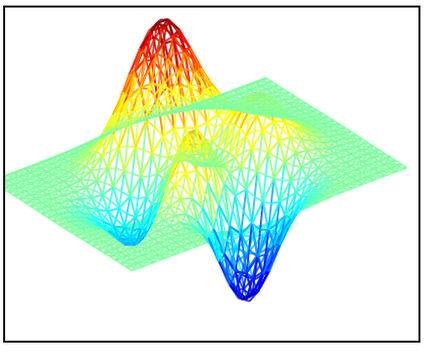
$uo := [\,0\ 1\,]$
$vo := [\,0\ 1\,]$
$S := pTMesh\left(G, TG, uo, vo\right)$
$S_3 := pZoom\left(S, z\right)$

$\text{rows}\left(S_3\right) = 2575$

true tri mesh

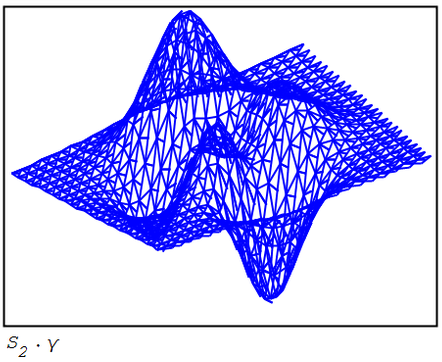


$S_1 \cdot Y$

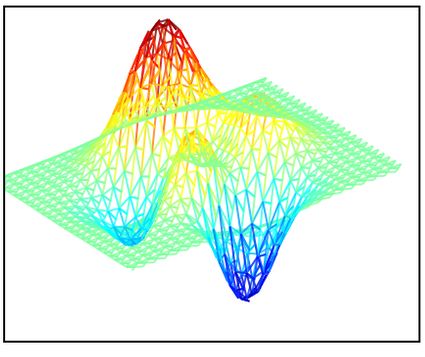


$pMeshShow\left(S_1, CM, Y\right)$

intermediate variation

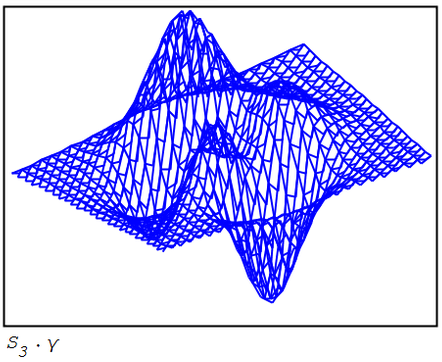


$S_2 \cdot Y$

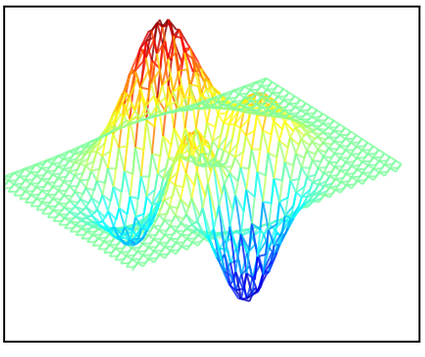


$pMeshShow\left(S_2, CM, Y\right)$

fast variation



$S_3 \cdot Y$



$pMeshShow\left(S_3, CM, Y\right)$

torus

$$R := 6 \quad r := 2$$

$$torus(u, v) := \begin{bmatrix} (R + r \cdot \cos(u)) \cdot \cos(v) \\ (R + r \cdot \cos(u)) \cdot \sin(v) \\ r \cdot \sin(u) \end{bmatrix}$$

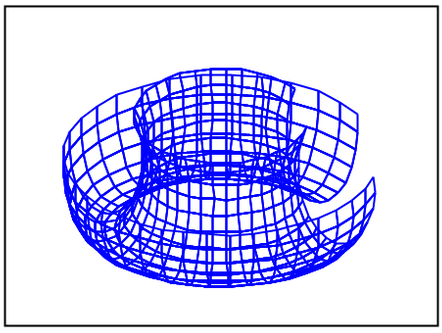
$$U := pR(-1.25 \cdot \pi, 0, 16)$$
$$V := pR(0, 1.75 \cdot \pi, 32)$$
$$G := pGrid(torus, U, V)$$
$$z := [1\ 1\ 2]$$

pMesh

$$uo := [0\ 0\ 1\ 1\ 0]$$
$$vo := [0\ 1\ 1\ 0\ 0]$$
$$S := pMesh(G, uo, vo)$$
$$S_1 := pZoom(S, z)$$

$\text{rows}(S_1) = 3056$

Viacheslav original mesh

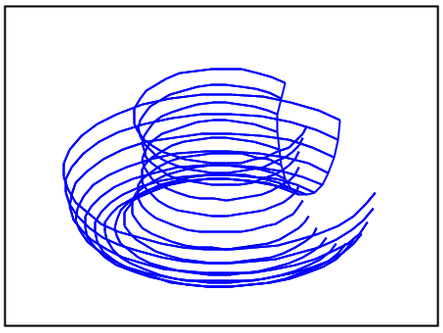


$S_1 \cdot Y$

$$uo := [0\ 0]$$
$$vo := [1\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_2 := pZoom(S, z)$$

$\text{rows}(S_2) = 1520$

waterfall along x

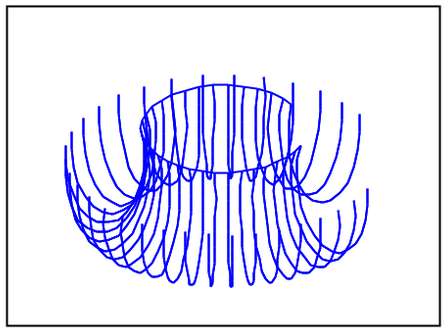


$S_2 \cdot Y$

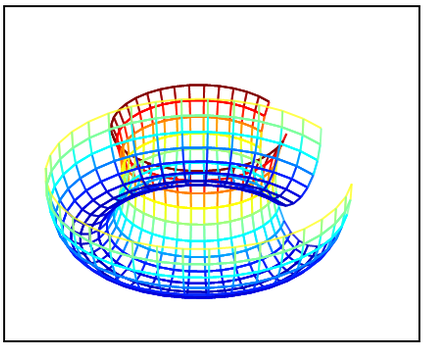
$$uo := [0\ 0]$$
$$vo := [1\ 1]$$
$$S := pMesh(G^{T}, uo, vo)$$
$$S_3 := pZoom(S, z)$$

$\text{rows}(S_3) = 1504$

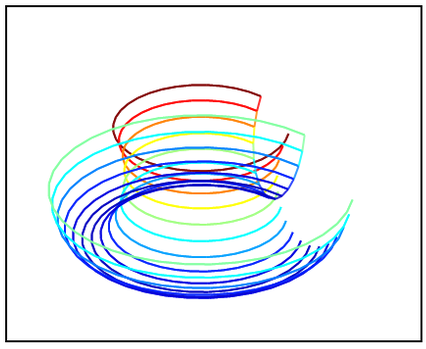
waterfall along y



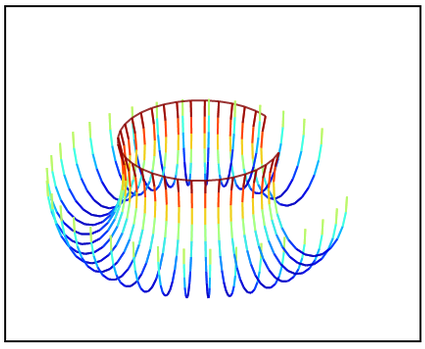
$S_3 \cdot Y$



$pMeshShow(S_1, CM, Y)$



$pMeshShow(S_2, CM, Y)$

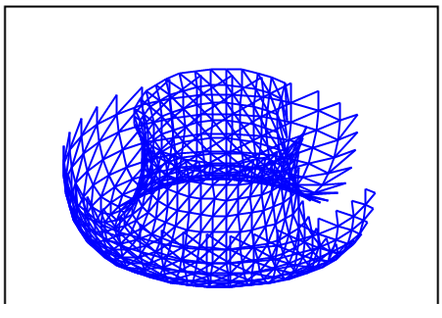


$pMeshShow(S_3, CM, Y)$

$$uo := [1\ 0]$$
$$vo := [0\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_1 := pZoom(S, z)$$

$\text{rows}(S_1) = 1520$

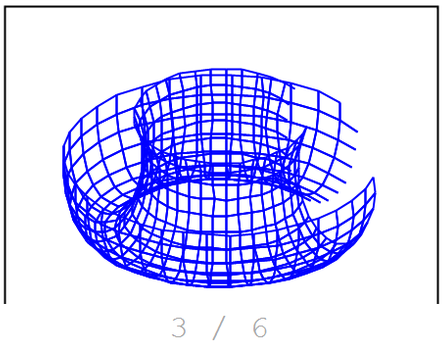
fake but fast trimesh



$$uo := [0\ 0\ 1]$$
$$vo := [0\ 1\ 1]$$
$$S := pMesh(G, uo, vo)$$
$$S_2 := pZoom(S, z)$$

$\text{rows}(S_2) = 2032$

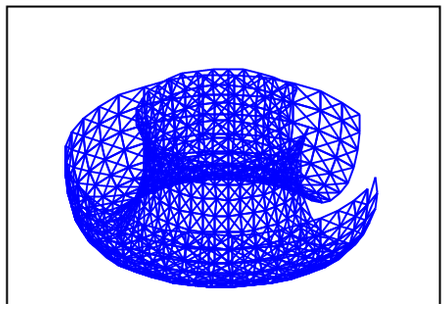
something else



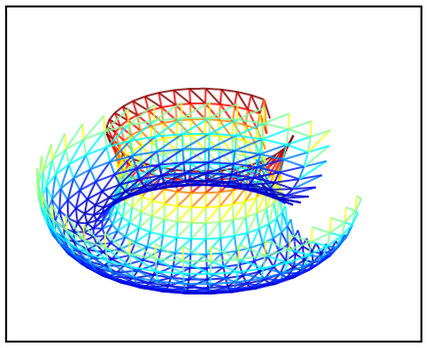
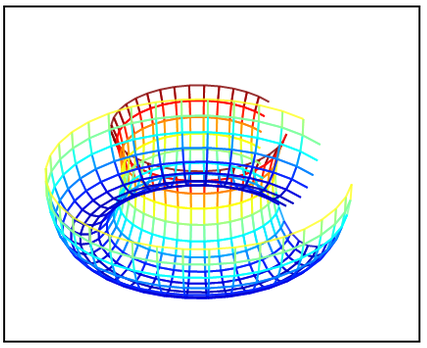
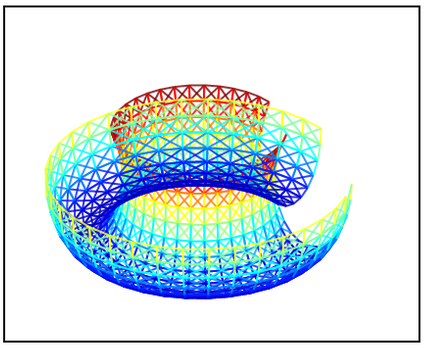
$$uo := [0\ 0\ 1\ 0\ 1]$$
$$vo := [0\ 1\ 1\ 0\ 0]$$
$$S := pMesh(G, uo, vo)$$
$$S_3 := pZoom(S, z)$$

$\text{rows}(S_3) = 3056$

fake but nice trimesh



$S_1 \cdot \gamma$ $S_2 \cdot \gamma$ $S_3 \cdot \gamma$

$pMeshShow(S_1, CM, \gamma)$ $pMeshShow(S_2, CM, \gamma)$ $pMeshShow(S_3, CM, \gamma)$

Trimesh

Trimesh $TG := pTGrid(torus, U, V)$

$uo := [0\ 0\ 1\ 0\ 1]$
$vo := [0\ 1\ 1\ 0\ 0]$
$S := pTMesh(G, TG, uo, vo)$
$S_1 := pZoom(S, z)$

$\text{rows}(S_1) = 3680$

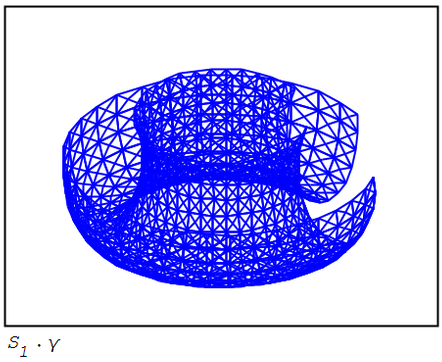
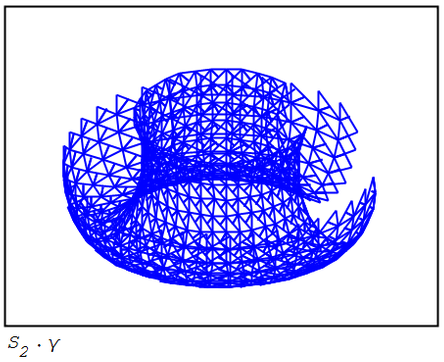
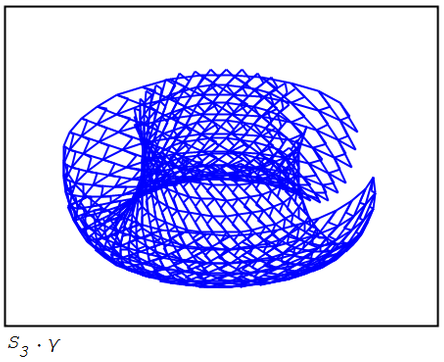
$uo := [0\ 1\ 0]$
$vo := [0\ 1\ 1]$
$S := pTMesh(G, TG, uo, vo)$
$S_2 := pZoom(S, z)$

$\text{rows}(S_2) = 2624$

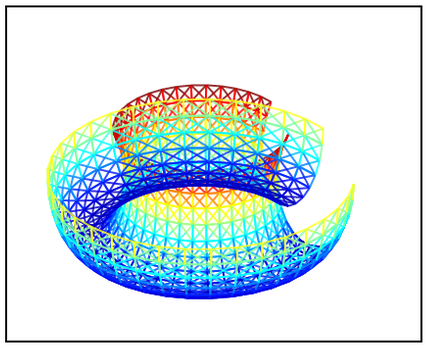
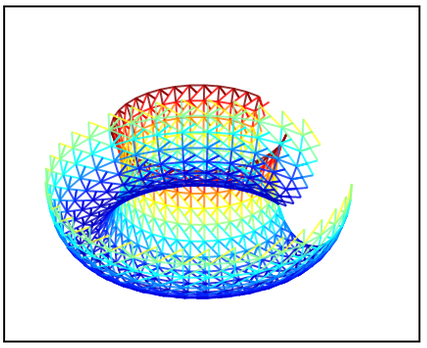
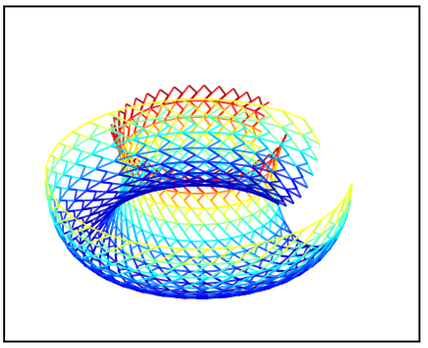
$uo := [0\ 1]$
$vo := [0\ 1]$
$S := pTMesh(G, TG, uo, vo)$
$S_3 := pZoom(S, z)$

$\text{rows}(S_3) = 2096$

true tri mesh intermediate variation fast variation

$S_1 \cdot \gamma$ $S_2 \cdot \gamma$ $S_3 \cdot \gamma$

$pMeshShow(S_1, CM, \gamma)$ $pMeshShow(S_2, CM, \gamma)$ $pMeshShow(S_3, CM, \gamma)$

---

wave

$f(r) := 0.5 \cdot \cos(4 \cdot r)$
$wave(r, \theta) := cyl2xyz([r\ \theta\ f(r)])$

$U := pR(0, 5, 20)$
$V := pR(0, 1.5 \cdot \pi, 30)$
$G := pGrid(wave, U, V)$
$z := [2\ 2\ 2]$

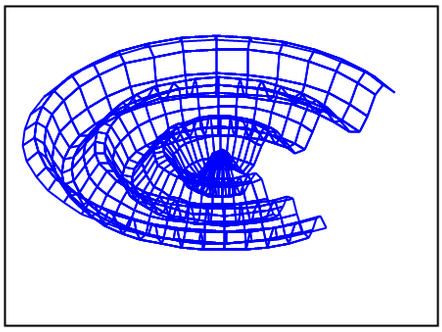
pMesh

$uo := [0\ 0\ 1\ 1\ 0]$ $uo := [0\ 0]$ $uo := [0\ 0]$

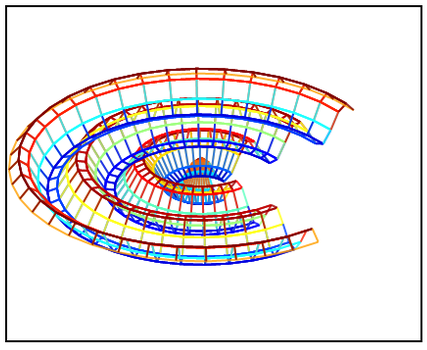
$vo := [0\ 1\ 1\ 0\ 0]$
$S := pMesh(G, uo, vo)$
$S_1 := pZoom(S, z)$

$\text{rows}(S_1) = 3580$

Viacheslav original mesh



$S_1 \cdot Y$

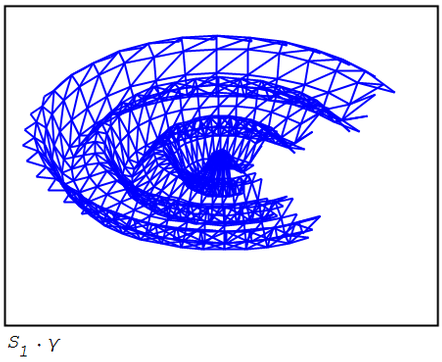


$pMeshShow(S_1, CM, Y)$

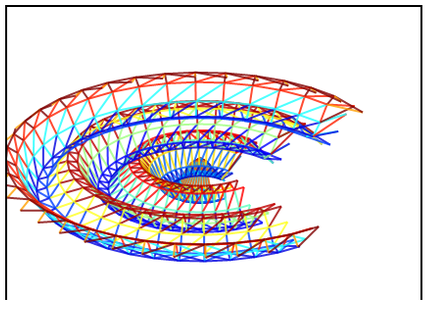
$uo := [1\ 0]$
$vo := [0\ 1]$
$S := pMesh(G, uo, vo)$
$S_1 := pZoom(S, z)$

$\text{rows}(S_1) = 1780$

fake but fast trimesh



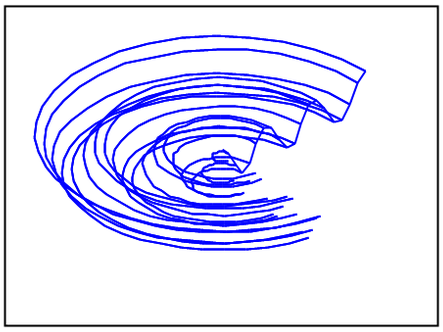
$S_1 \cdot Y$



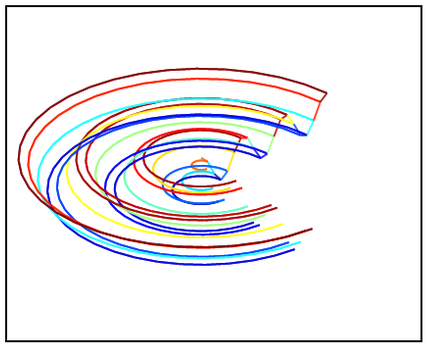
$vo := [1\ 1]$
$S := pMesh(G, uo, vo)$
$S_2 := pZoom(S, z)$

$\text{rows}(S_2) = 1780$

waterfall along x



$S_2 \cdot Y$

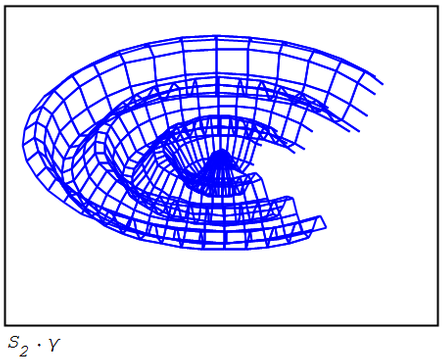


$pMeshShow(S_2, CM, Y)$

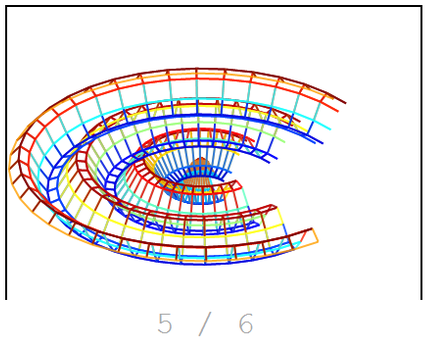
$uo := [0\ 0\ 1]$
$vo := [0\ 1\ 1]$
$S := pMesh(G, uo, vo)$
$S_2 := pZoom(S, z)$

$\text{rows}(S_2) = 2380$

something else



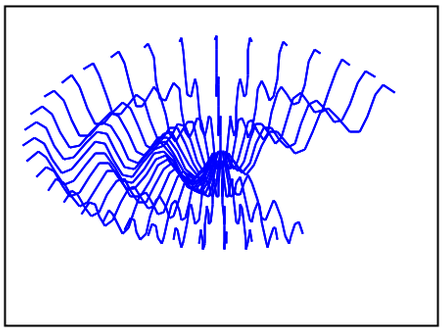
$S_2 \cdot Y$



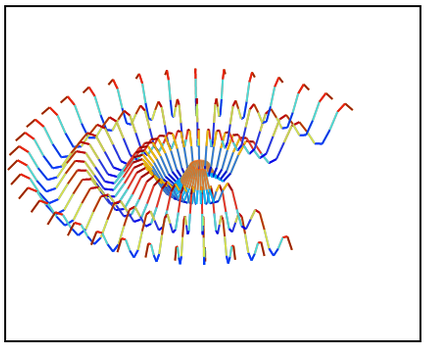
$vo := [1\ 1]$
$S := pMesh(G^{T}, uo, vo)$
$S_3 := pZoom(S, z)$

$\text{rows}(S_3) = 1770$

waterfall along y



$S_3 \cdot Y$

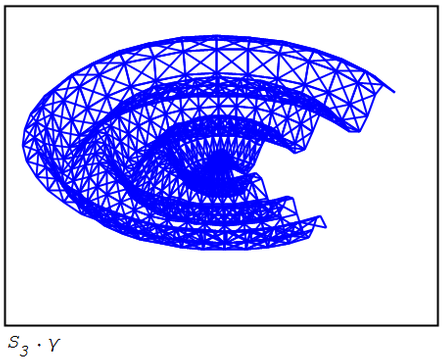


$pMeshShow(S_3, CM, Y)$

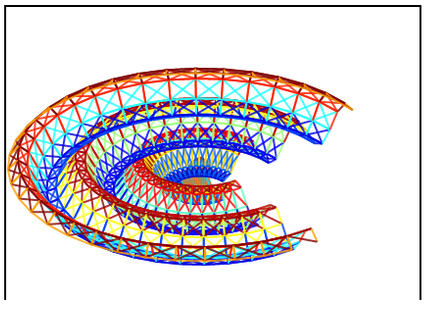
$uo := [0\ 0\ 1\ 0\ 1]$
$vo := [0\ 1\ 1\ 0\ 0]$
$S := pMesh(G, uo, vo)$
$S_3 := pZoom(S, z)$

$\text{rows}(S_3) = 3580$

fake but nice trimesh



$S_3 \cdot Y$



$pMeshShow(S_1, CM, Y)$ $pMeshShow(S_2, CM, Y)$ $pMeshShow(S_3, CM, Y)$

Trimesh

Trimesh $TG := pTGrid(wave, U, V)$

$uo := [0\ 0\ 1\ 0\ 1]$
$vo := [0\ 1\ 1\ 0\ 0]$
$S := pTMesh(G, TG, uo, vo)$
$S_1 := pZoom(S, z)$

$rows(S_1) = 4320$

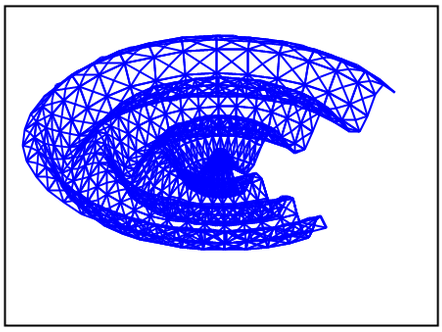
$uo := [0\ 1\ 0]$
$vo := [0\ 1\ 1]$
$S := pTMesh(G, TG, uo, vo)$
$S_2 := pZoom(S, z)$

$rows(S_2) = 3080$

$uo := [0\ 1]$
$vo := [0\ 1]$
$S := pTMesh(G, TG, uo, vo)$
$S_3 := pZoom(S, z)$

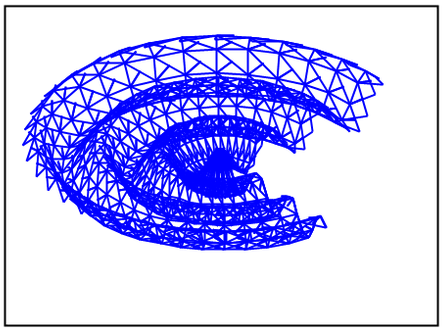
$rows(S_3) = 2460$

true tri mesh



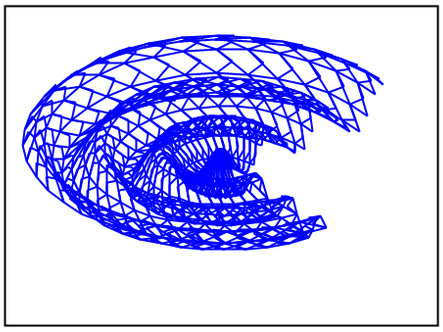
$S_1 \cdot Y$

intermediate variation

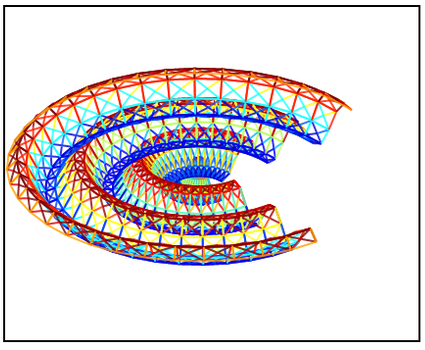


$S_2 \cdot Y$

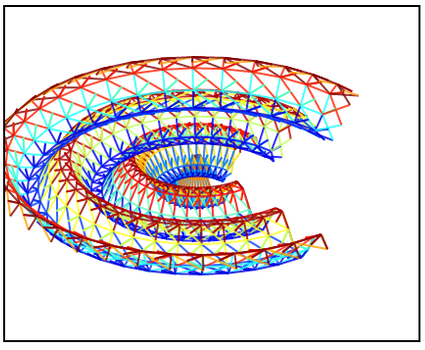
fast variation



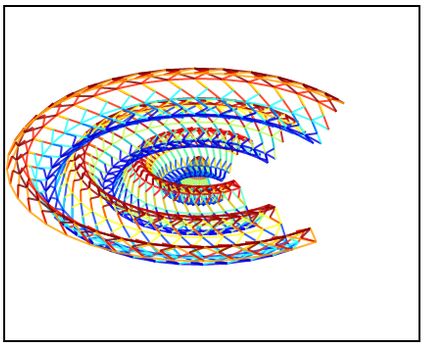
$S_3 \cdot Y$



$pMeshShow(S_1, CM, Y)$



$pMeshShow(S_2, CM, Y)$



$pMeshShow(S_3, CM, Y)$

Alvaro