

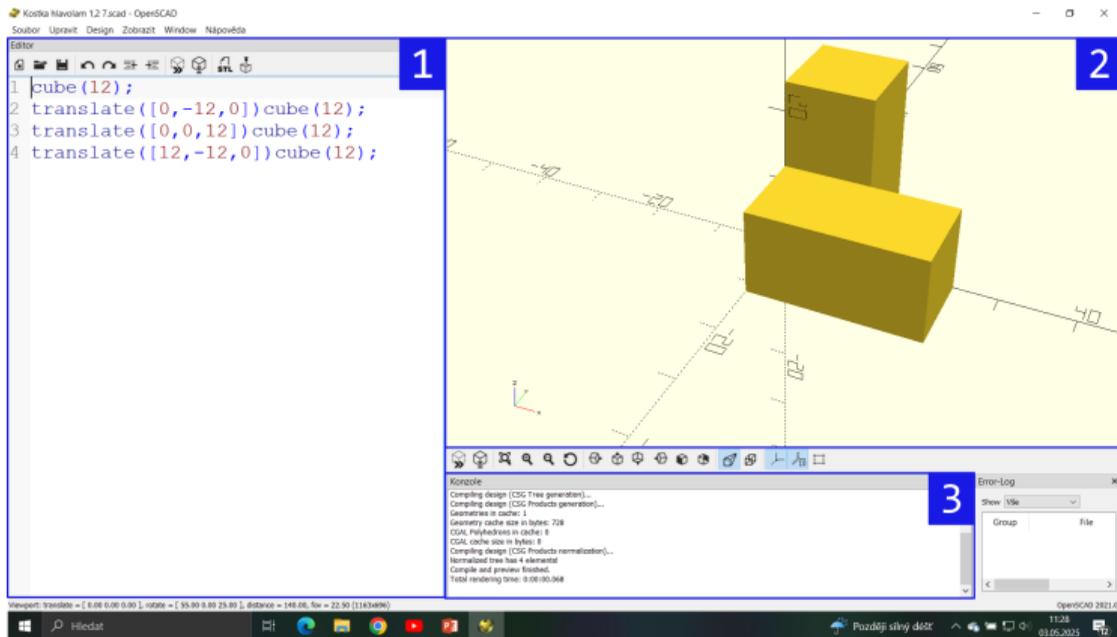
Open Scad – modelování 3D

Maker Faire – Praha – 2025
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8. května 2025

Prostředí OpenSCADU

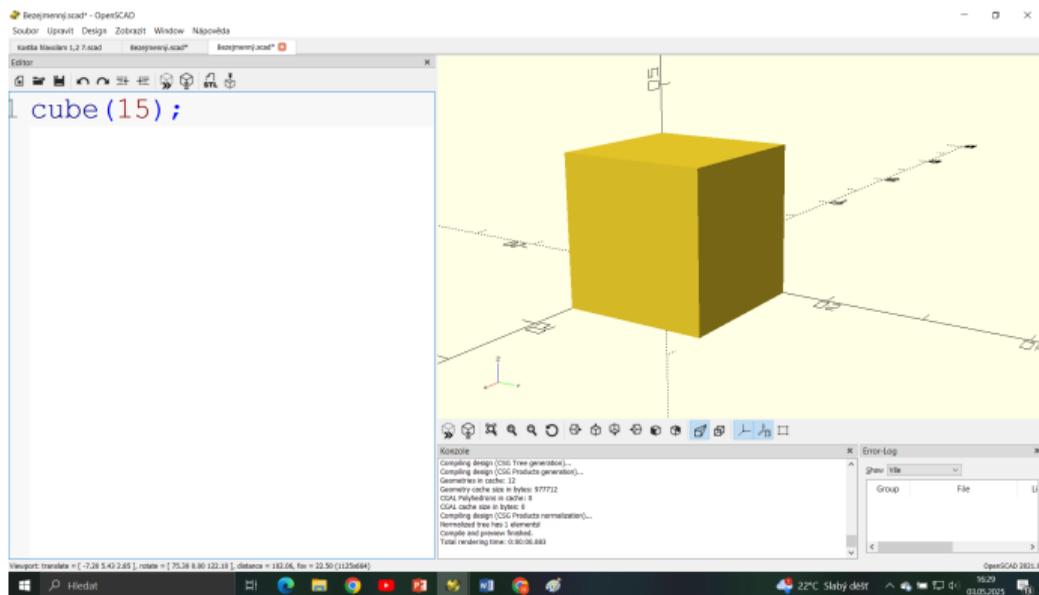
1. editor
2. náhled – zobrazení těles pomocí **F5** / **Ctrl** + **S**
3. upozornění na problémy



Druhy těles a jejich zápis – krychle

1 `cube (a) ;`

► a: délka hrany

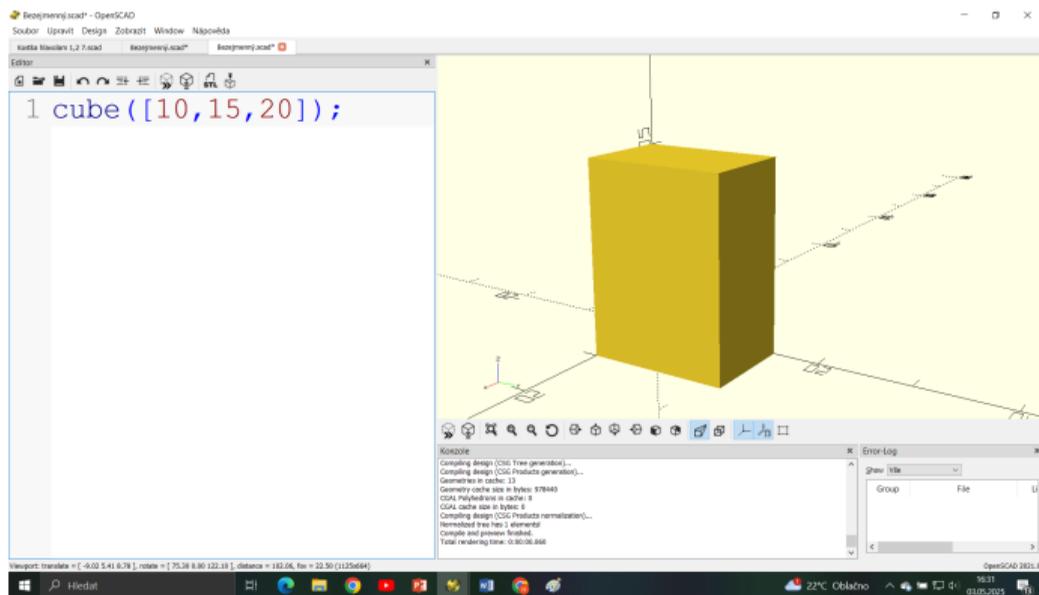


Obrázek: Krychle o délce hrany 15 mm

Druhy těles a jejich zápis – kvádr

1 `cube([a, b, c]);`

- ▶ a: délka hrany v ose X
- ▶ b: délka hrany v ose Y
- ▶ c: délka hrany v ose Z

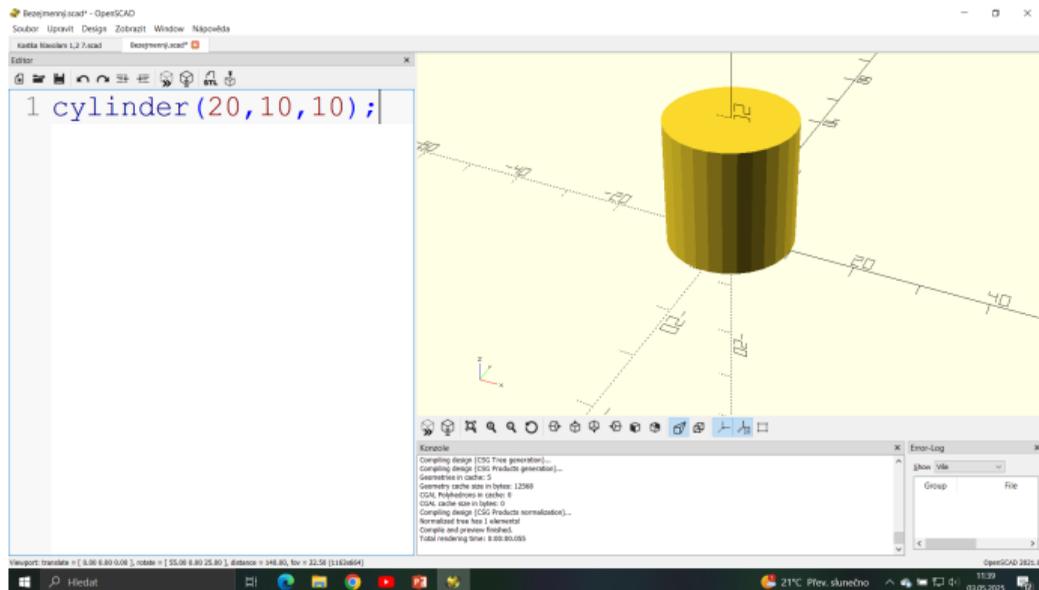


Obrázek: Kvádr s rozměry 10 mm × 15 mm × 20 mm

Druhy těles a jejich zápis – válec

1 `cylinder(h, r1, r2);`

- ▶ h: výška
- ▶ r₁: poloměr dolní podstavy
- ▶ r₂: poloměr horní podstavy



Obrázek: Válec o poloměru podstavy 10 mm a výškou 20 mm:

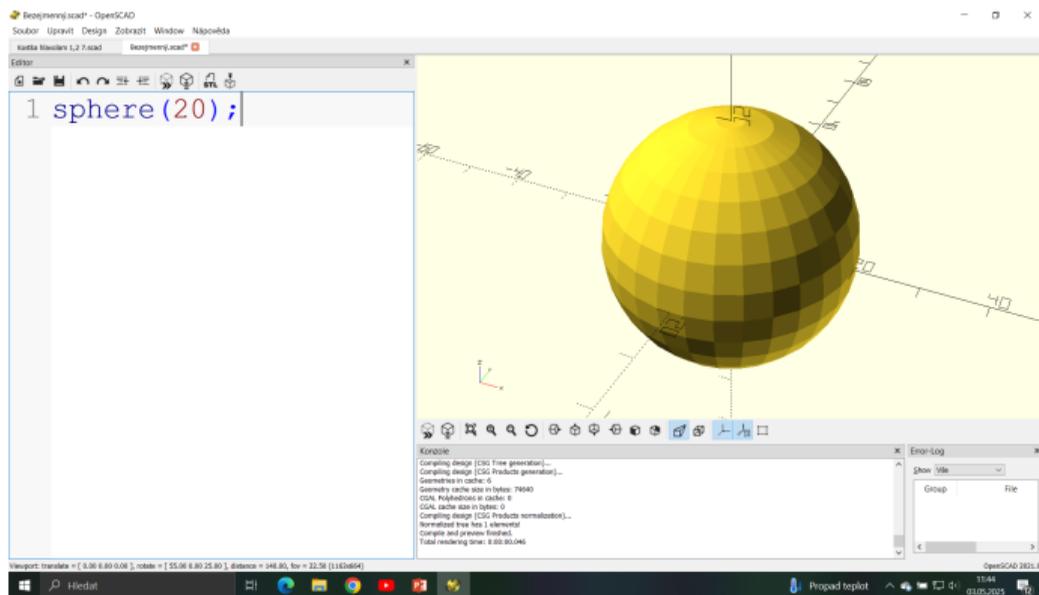
Druhy těles a jejich zápis – koule

1 `sphere (r) ;`

- ▶ `r`: poloměr koule
- ▶ "hranatost" koule vyhladíme zadáním většího počtu stran `n`-úhelníku – pomocí proměnné `$fn`:

1 `$fn = 100;`

- ▶ pro znak `$` na české klávesnici: `AltGr` + `ů`



Obrázek: Koule o poloměru 20 mm

Vyhlazená koule o poloměru 20 mm pomocí \$fn

Bezejmenný.scad* - OpenSCAD

Soubor Upravit Design Zobrazit Window nápověda

kostka hlavolam 1,2 7.scad Bezejmenný.scad*

Editor

```
1 $fn=100;  
2 sphere(20);
```

Konzole

- Compiling design (CSG Tree generation)...
- Compiling design (CSG Products generation)...
- Geometries in cache: 8
- Geometry cache size in bytes: 961044
- CGAL Polyhedrons in caches: 0
- CGAL cache size in bytes: 0
- Compiling design (CSG Products normalization)...
- Normalized tree has 1 elements
- Compile and preview finished.
- Total rendering time: 0:00:00.070

Viewport: translate = [0.00 0.00 0.00], rotate = [35.00 0.00 25.00], distance = 140.00, fov = 22.50 (1163664)

OpenSCAD 2021.01

11:47
03.05.2025

21°C Slunečno

Manipulace s objekty na ploše

- ▶ posunutí objektu [mm]:

```
1 translate([x, y, z]) ...
```

- ▶ rotace objektu [°]:

```
1 rotate([x, y, z]) ...
```

- ▶ škálování objektu:

```
1 scale([x, y, z]) ...
```

Posunutí koule ve směru osy Z (nahoru) o poloměr 20 mm

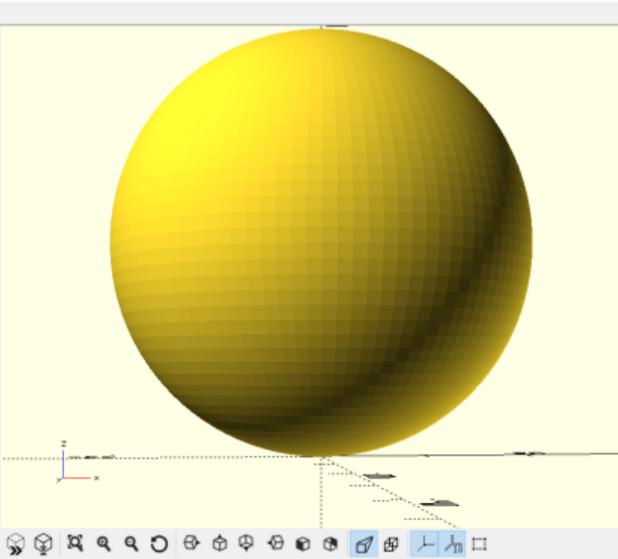
Bezejmenný.scad* - OpenSCAD

Soubor Upravit Design Zobrazit Window nápověda

kostka hlavolam 1,2 7.scad Bezejmenný.scad*

Editor

```
1 $fn=100;  
2 translate([0,0,20])sphere(20);
```



Konzole

Compiling design (CSG Tree generation)...
Compiling design (CSG Products generation)...
Geometries in cache: 8
Geometry cache size in bytes: 960544
CGAL Polyhedrons in cache: 0
CGAL cache size in bytes: 0
Compiling design (CSG Products normalization)...
Normalized tree has 1 element
Compile and preview finished.
Total rendering time: 0:00:00.071

Error-Log

Group	File
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Viewport: translate = [0.11 6.53 17.32], rotate = [94.20 0.00 352.80], distance = 126.00, fov = 22.50 (837x664)

OpenSCAD 2021.01

11:58
03.05.2025

21°C Slunečno

Hledat

Otočení kvádru o 45° kolem osy z

Bezejmenný.scad* - OpenSCAD

Soubor Upravit Design Zobrazit Window Nápověda

kostka hlavolem 1,2 7.scad Bezejmenný.scad*

Editor

```
1 rotate([0,0,45]) cube([10,15,20]);
```

Viewport: translate = [-0.95 1.65 9.83], rotate = [57.10 0.00 343.70], distance = 126.00, fov = 22.50 (761x664)

Konzole

- Compiling design (CSG Tree generation)...
- Compiling design (CSG Products generation)...
- Geometries in cache: 8
- Geometry cache size in bytes: 96044
- CGAL Polyhedrons in cache: 0
- CGAL cache size in bytes: 0
- Compiling design (CSG Products normalization)...
- Normalized tree has 1 elemental
- Compile and preview finished.
- Total rendering time: 0:00:00.856

Error-Log

Group	File
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OpenSCAD 2021.01

12:02
03.05.2025

Kombinace – otočení a posun najednou

```
1 translate([0,0,15]) rotate([0,90,0]) cylinder(10,15,15);
```

The screenshot displays the OpenSCAD interface. The main window shows a 3D view of a yellow cylinder with a diameter of 10 units and a height of 15 units. The cylinder is oriented vertically, indicating it has been rotated 90 degrees around the x-axis. It is positioned 15 units along the z-axis from the origin. The left sidebar contains the SCAD code editor with the following code:

```
1 translate([0,0,15])  
  rotate([0,90,0])  
  cylinder(10,15,15);
```

At the bottom of the interface, the console window shows the following output:

```
Konzole  
Compiling design (CSG Tree generation)...  
Compiling design (CSG Products generation)...  
Geometries in cache: 12  
Geometry cache size in bytes: 977712  
CGAL Polyhedrons in cache: 0  
CGAL cache size in bytes: 0  
Compiling design (CSG Products normalization)...  
Normalized tree has 1 element!  
Compile and preview finished.  
Total rendering time: 0:00:00.065
```

The status bar at the bottom indicates the viewport coordinates: `Viewport: translate = [-1.82 -1.31 17.11], rotate = [74.69 0.00 211.70], distance = 102.06, fov = 22.50 (1125e64)`. The system tray shows the date and time as 12:15 on 03.05.2025.

Množinové operace

▶ sjednocení:

```
1 union() { ... více objektů ... }
```

▶ rozdíl:

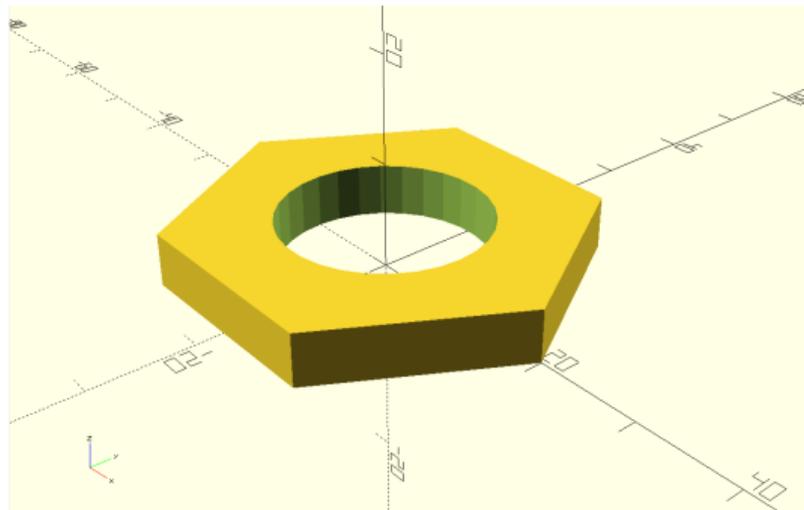
```
1 difference() { objekt; odebírané objekty }
```

▶ průnik:

```
1 intersection() { objekt; objekt }
```

Rozdíl I

```
1 difference() {  
2     cylinder(5, 20, 20, $fn=6);  
3     cylinder(5, 10, 10);  
4 }
```



Rozdíl II

Kostka kostkascad* - OpenSCAD

Soubor Upravit Design Zobrazit Window Nápověda

Editor

```
1 difference() {
2   cube([41,41,41]);
3   translate([1.5,1.5,1.5])cube([38,38,40]);
4   $fn = 8;
5   translate([20.5,20.5,0])cylinder(43,r=
6     10,r=10);
7   translate([41,20.5,17])rotate([0,-90,0
8     ])cylinder(43,r=18,r=18,$fn = 3);
9   translate([20.5,41,17])rotate([0,-90,90
10     ])cylinder(43,r=18,r=18,$fn = 3);
```

Komplexe výtvořila 3 varování. For details see the [error log](#) and [console window](#).

Konzole

Total rendering time: 0:00:00.106
Top level object is a 3D object:
Simple: yes
Vertices: 56
HalfEdges: 168
Edges: 84
HalfFacets: 62
Facets: 31
Volumes: 2
Rendering finished.

Error-Log

Group	File
WARNING	Kostka kostka.sc
WARNING	Kostka kostka.sc

Viewport: translate = [18.25 19.03 16.82], rotate = [66.90 0.00 204.90], distance = 172.84, fov = 22.50 (1082x651)

OpenSCAD 2021.01 89 %

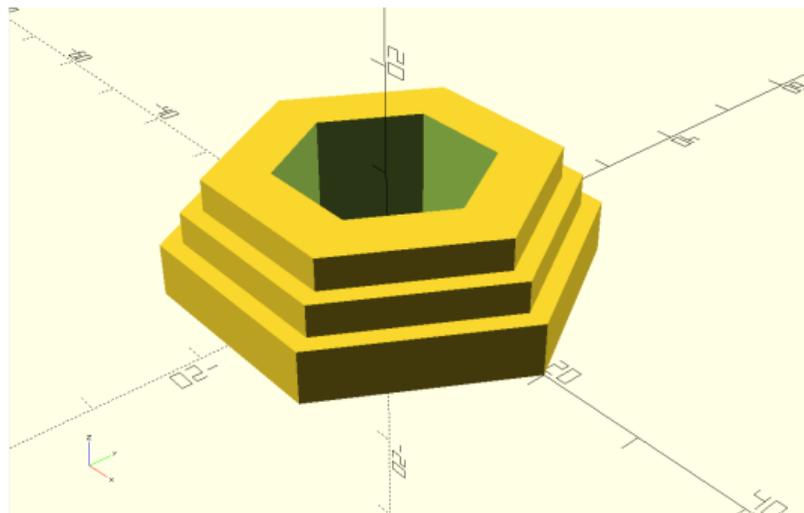
24°C Polojasno 12:54 03.05.2025

Rozdíl II

```
1 difference(){
2   cube([41,41,41]) ;
3   translate([1.5,1.5,1.5]) cube([38,38,40]);
4   $fn = 8;
5   translate([20.5,20.5,0]) cylinder(43,r=10,r=10);
6   translate([41,20.5,17]) rotate([0,-90,0]) cylinder(43,r=18,r=18,$fn = 3);
7   translate([20.5,41,17]) rotate([0,-90,90]) cylinder(43,r=18,r=18,$fn = 3);
8 }
```

Sjednocení I

```
1 $fn = 6;  
2 difference() {  
3   union() {  
4     cylinder(5, 20, 20);  
5     cylinder(8, 18, 18);  
6     cylinder(11, 16, 16);  
7   }  
8   cylinder(11, 10, 10);  
9 }
```



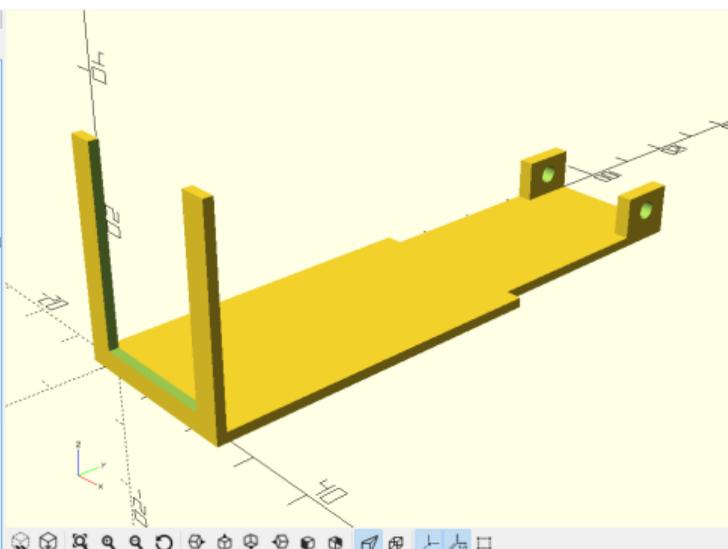
Sjednocení II

Kapota na dlouhé auto.scad* - OpenSCAD

Soubor Upravit Design Zobrazit Window Nápověda

Editor

```
1 $fn=20;  
2 cube([23,89,1.5]);  
3 difference() {  
4 union() {  
5 translate([0,80,0]) cube([2.4,9,8]);  
6 translate([20.6,80,0]) cube([2.4,9,8]);  
7 }  
8 translate([0,84.5,5]) rotate([0,90,0])  
   cylinder(h=30,r=1.5);  
9 }  
10 translate([-2.5,-2,0]) cube([28,54,1.5]);  
11 difference() {  
12 translate([-2.5,-2,0]) cube([28,1.5,32]);  
13 translate([1.5,-2,3]) cube([20,1.5,29]);  
14 }
```



Konzole

Total rendering time: 0:00:01.227
Top level object is a 3D object:
Simple: yes
Vertices: 120
Halfedges: 360
Edges: 180
HalfFacets: 124
Facets: 62
Volumes: 2
Rendering finished.

Error-Log

Group	File
-------	------

Viewport: translate = [18.46 28.69 11.15], rotate = [64.10 0.00 48.10], distance = 172.84, fov = 22.50 (970x684)

OpenSCAD 2021.01

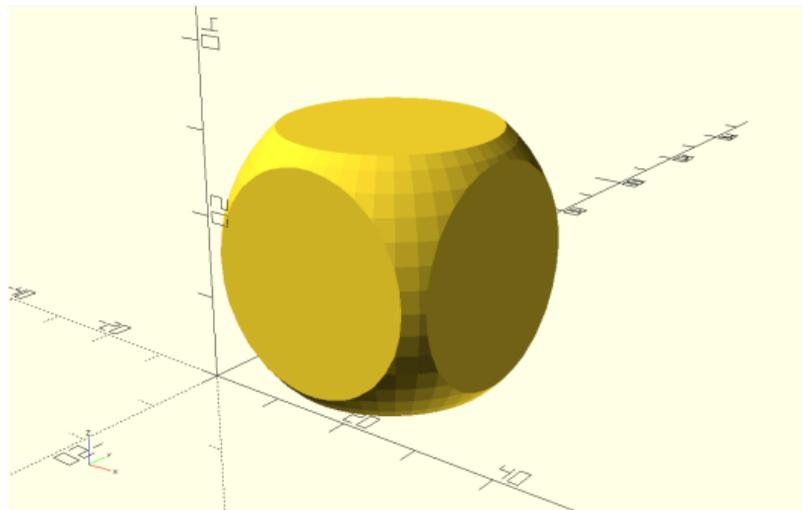
Propad teplot 13:20 03.05.2025

Sjednocení II

```
1 $fn=20;
2 cube([23,89,1.5]);
3 difference() {
4     union() {
5         translate([0,80,0]) cube([2.4,9,8]);
6         translate([20.6,80,0]) cube([2.4,9,8]);
7     }
8     translate([0,84.5,5]) rotate([0,90,0]) cylinder(h=30,r=1.5);
9 }
10
11 translate([-2.5,-2,0]) cube([28,54,1.5]);
12 difference() {
13     translate([-2.5,-2,0]) cube([28,1.5,32]);
14     translate([1.5,-2,3]) cube([20,1.5,29]);
15 }
```

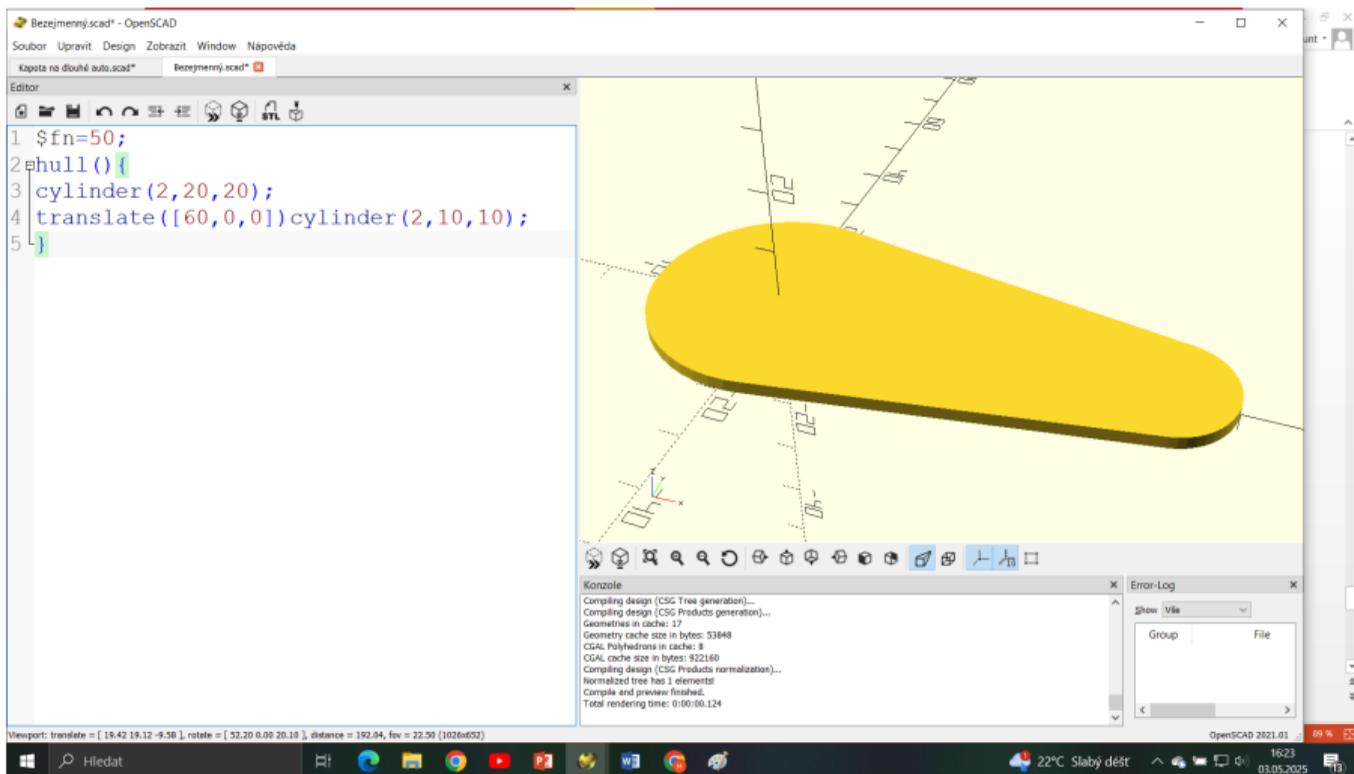
Průnik

```
1 $fn=50;  
2 intersection(){  
3   cube(30);  
4   translate([15,15,15]) {  
5     sphere(20);  
6   }  
7 }
```



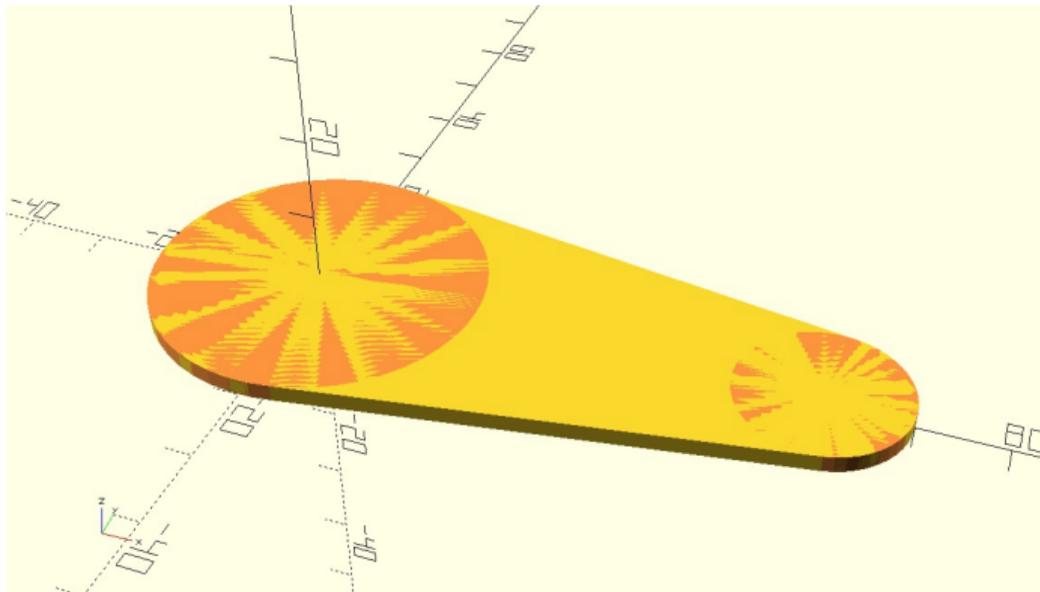
Konvexní obálka

```
1 hull() { ... více objektů ... }
```



Konvexní obálka

```
1 $fn=50;  
2 hull(){  
3   cylinder(2,20,20);  
4   translate([60,0,0]) cylinder(2,10,10);  
5 }
```



Proměnné

- ▶ mohou být využity v kódu místo konstant
- ▶ zavedení parametrů objektů → jednodušší úprava
- ▶ deklarace:

```
1 a = 15;
```

- ▶ využití v kódu:

```
1 a = 15;  
2  
3 cube(a);  
4 translate([0, -a, 0]) cube(a);  
5 translate([0, 0, a]) cube(a);  
6 translate([a, -a, 0]) cube(a);
```

Kostičkový hlavolam – snadný start pro žáky



Kostičkový hlavolam – nácvik operací s objekty

