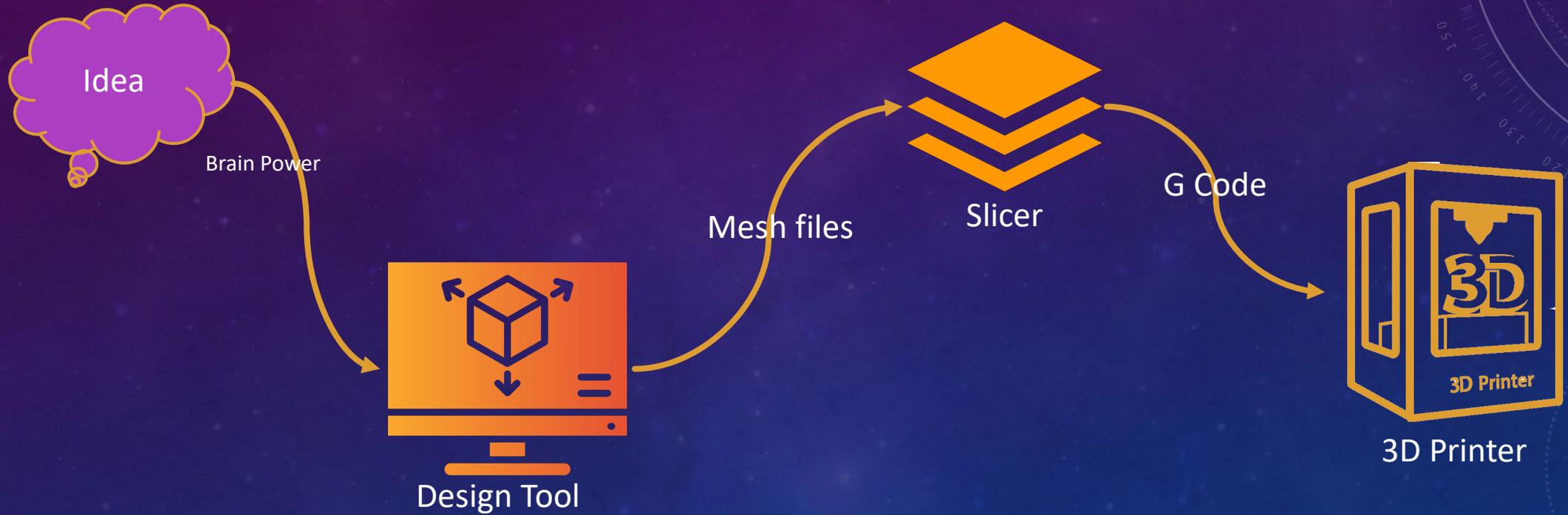
The background features a dark blue gradient with a subtle starfield. On the left side, there is a large, semi-transparent frequency dial with numerical markings from 140 to 260. Several circular and semi-circular graphic elements, including dashed lines and arrows, are scattered across the scene, creating a technical and futuristic aesthetic.

3D PRINTING IN AMATEUR RADIO

TOOLS FOR ENHANCING OUR RADIO OPERATING

MAIN WORKFLOW



SOFTWARE COMPONENTS

- Design Tools

- GUI Tools

- Autodesk Fusion
 - FreeCAD
 - TinkerCAD

- Program Tools

- OpenSCAD

- Slicer Tools

- Orca
 - UltiMaker Cura
 - PrusaSlicer

FINISHED PRINT



OPENS CAD

THE PROGRAMMERS SOLID 3D CAD MODELLER

[HTTPS://OPENS CAD.ORG/CHEATSHEET/INDEX.HTML](https://opencad.org/cheatsheet/index.html)

OpenSCAD v2021.01

Syntax
`var = value;`
`var = cond ? value_if_true : value_if_false;`
`var = function (x) x + x;`
`# highlight / debug`
`% transparent / background`
`module name(...) { ... }`
`name();`
`function name(...) = ...`
`name();`
`include <...scad>`
`use <...scad>`

Constants
`undef` undefined value
`PI` mathematical constant π (~3.14159)

Operators
`n + n` Addition
`n - n` Subtraction
`n * n` Multiplication
`n / n` Division
`n % n` Modulo
`n ^ n` Exponentiation
`n < n` Less Than
`n <= n` Less or Equal
`b == c` Equal
`b != c` Not Equal
`n >= n` Greater or Equal
`n > n` Greater Than
`b && c` Logical And
`b || c` Logical Or
`!b` Negation

Special variables
`$fa` minimum angle
`$fs` minimum size
`$fn` number of segments
`$t` animation step
`$vpr` viewport rotation angles in degrees
`$vpt` viewport translation
`$vrd` viewport camera distance
`$vrf` viewport camera field of view
`$children` number of module children
`$preview` true in F5 preview, false for F6

Modifier Characters
`!` disable
`!` show only
`#` highlight / debug
`%` transparent / background

2D
`circle(radius | d=diameter)`
`square(size,center)`
`square([width,height],center)`
`polygon([points])`
`polygon([points],[paths])`
`text(t, size, font, direction, language, script, halign, valign, spacing)`
`import("...ext", convexity)`
`projection(cut)`

3D
`sphere(radius | d=diameter)`
`cube(size, center)`
`cube([width,depth,height], center)`
`cylinder(h,r[d,center])`
`cylinder(h,r1[d1,r2[d2,center])`
`polyhedron(points, faces, convexity)`
`import("...ext", convexity)`
`linear_extrude(height,center,convexity,twist,slices)`
`rotate_extrude(angle,convexity)`
`surface(file = "...ext",center,convexity)`

Transformations
`translate([x,y,z])`
`rotate([x,y,z])`
`rotate(a, [x,y,z])`
`scale([x,y,z])`
`resize([x,y,z],auto,convexity)`
`mirror([x,y,z])`
`multmatrix(m)`
`color("colorname",alpha)`
`color("#hexvalue")`
`color([r,g,b,a])`
`offset(r[delta,chanfer])`
`hull()`
`minkowski(convexity)`

Lists
`list=[...]`: create a list
`var = list[2]`: index a list (from 0)
`var = list.z`: dot notation indexing (x/y/z)

Boolean operations
`union()`
`difference()`
`intersection()`

List Comprehensions
`Generate [for (t = range|list) t]`
`Generate [for (init;condition;next) t]`
`Flatten [each t]`
`Conditions [for (t = ...) if (condition(t)) t]`
`Conditions [for (t = ...) if (condition(t)) x else y]`
`Assignments [for (t = ...) let (assignments) a]`

Flow Control
`for (t = [start:end]) { ... }`
`for (t = [start:step:end]) { ... }`
`for (t = [..,.,.]) { ... }`
`for (t = .., j = .., ..) { ... }`
`intersection_for(t = [start:end]) { ... }`
`intersection_for(t = [start:step:end]) { ... }`
`intersection_for(t = [..,.,.]) { ... }`
`if (..) { ... }`
`let (..) { ... }`

Type test functions
`is_undef`
`is_bool`
`is_num`
`is_string`
`is_list`
`is_function`

Other
`echo(...)`
`render(convexity)`
`children([idx])`
`assert(condition, message)`
`assign (<=>){...}`

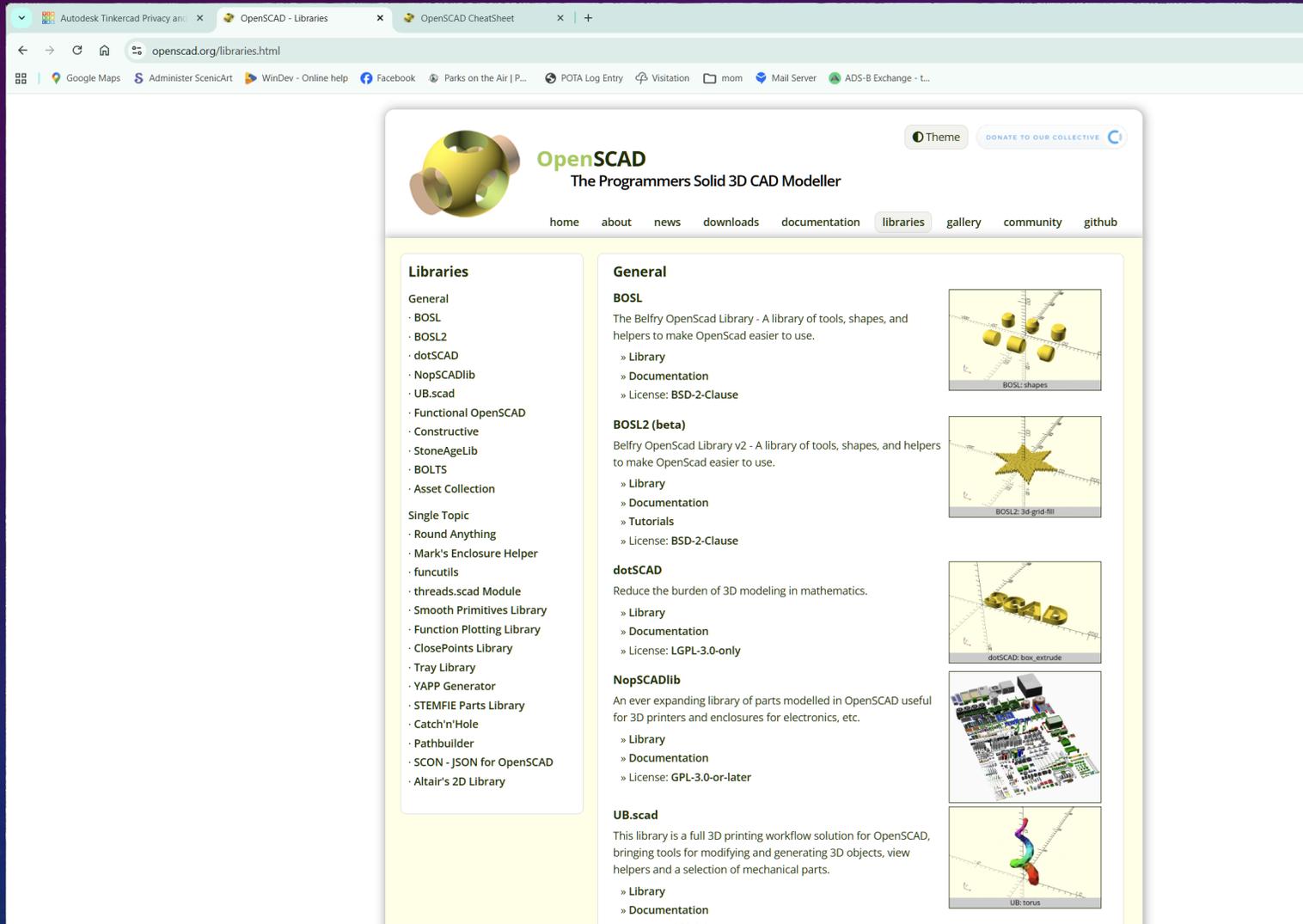
Functions
`concat`
`lookup`
`str`
`chr`
`ord`
`search`
`version`
`version_num`
`parent_module([idx])`

Mathematical
`abs`
`sign`
`sin`
`cos`
`tan`
`acos`
`asin`
`atan`
`atan2`
`floor`
`round`
`ceil`
`ln`
`len`
`let`
`log`
`pow`
`sqrt`
`exp`
`rand`
`min`
`max`
`norm`
`cross`

Links: [Official website](#) | [Code](#) | [Issues](#) | [Manual](#) | [MCAD library](#) | [Mailing list](#) | [Other links](#)

MANY LIBRARY FUNCTIONS

[HTTPS://OPENS CAD.ORG/LIBRARIES.HTML](https://openscad.org/libraries.html)



The screenshot shows the OpenSCAD website's 'Libraries' page. The page header includes the OpenSCAD logo, the tagline 'The Programmers Solid 3D CAD Modeller', and navigation links for home, about, news, downloads, documentation, libraries (active), gallery, community, and github. There are also buttons for 'Theme' and 'DONATE TO OUR COLLECTIVE'. The main content is organized into two columns. The left column, titled 'Libraries', lists various categories: General (BOSL, BOSL2, dotSCAD, NopSCADlib, UB.scad, Functional OpenSCAD, Constructive, StoneAgeLib, BOLTS, Asset Collection), Single Topic (Round Anything, Mark's Enclosure Helper, funcutils, threads.scad Module, Smooth Primitives Library, Function Plotting Library, ClosePoints Library, Tray Library, YAPP Generator, STEMFIE Parts Library, Catch'n'Hole, Pathbuilder, SCON - JSON for OpenSCAD, Altair's 2D Library), and General (BOSL, BOSL2 (beta), dotSCAD, NopSCADlib, UB.scad). Each category includes links to its respective library, documentation, and license information. The right column features 3D renderings of objects from each library: BOSL shapes, BOSL2 3d grid fill, dotSCAD box_extrude, NopSCADlib parts, and UB torus.

OpenSCAD
The Programmers Solid 3D CAD Modeller

home about news downloads documentation **libraries** gallery community github

Libraries

General

- BOSL
- BOSL2
- dotSCAD
- NopSCADlib
- UB.scad
- Functional OpenSCAD
- Constructive
- StoneAgeLib
- BOLTS
- Asset Collection

Single Topic

- Round Anything
- Mark's Enclosure Helper
- funcutils
- threads.scad Module
- Smooth Primitives Library
- Function Plotting Library
- ClosePoints Library
- Tray Library
- YAPP Generator
- STEMFIE Parts Library
- Catch'n'Hole
- Pathbuilder
- SCON - JSON for OpenSCAD
- Altair's 2D Library

General

BOSL

The Belfry OpenScad Library - A library of tools, shapes, and helpers to make OpenScad easier to use.

- » [Library](#)
- » [Documentation](#)
- » License: [BSD-2-Clause](#)

BOSL2 (beta)

Belfry OpenScad Library v2 - A library of tools, shapes, and helpers to make OpenScad easier to use.

- » [Library](#)
- » [Documentation](#)
- » [Tutorials](#)
- » License: [BSD-2-Clause](#)

dotSCAD

Reduce the burden of 3D modeling in mathematics.

- » [Library](#)
- » [Documentation](#)
- » License: [LGPL-3.0-only](#)

NopSCADlib

An ever expanding library of parts modelled in OpenSCAD useful for 3D printers and enclosures for electronics, etc.

- » [Library](#)
- » [Documentation](#)
- » License: [GPL-3.0-or-later](#)

UB.scad

This library is a full 3D printing workflow solution for OpenSCAD, bringing tools for modifying and generating 3D objects, view helpers and a selection of mechanical parts.

- » [Library](#)
- » [Documentation](#)
- » License: [CC0-1.0](#)

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- Some icons from Flaticon.com
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- TinkerCAD is free to use, owned by Autodesk Inc.
- OpenSCAD is [Free Software](#) released under the [General Public License version 2](#).

START DESIGNING

