

Modelování a 3D tisk

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#PomahameTvorit

O mně

MakersLab spoluzakladatel

3D printing consultant

Nové technologie

IT/telco

Cestování & fotografie

Běhám maratony

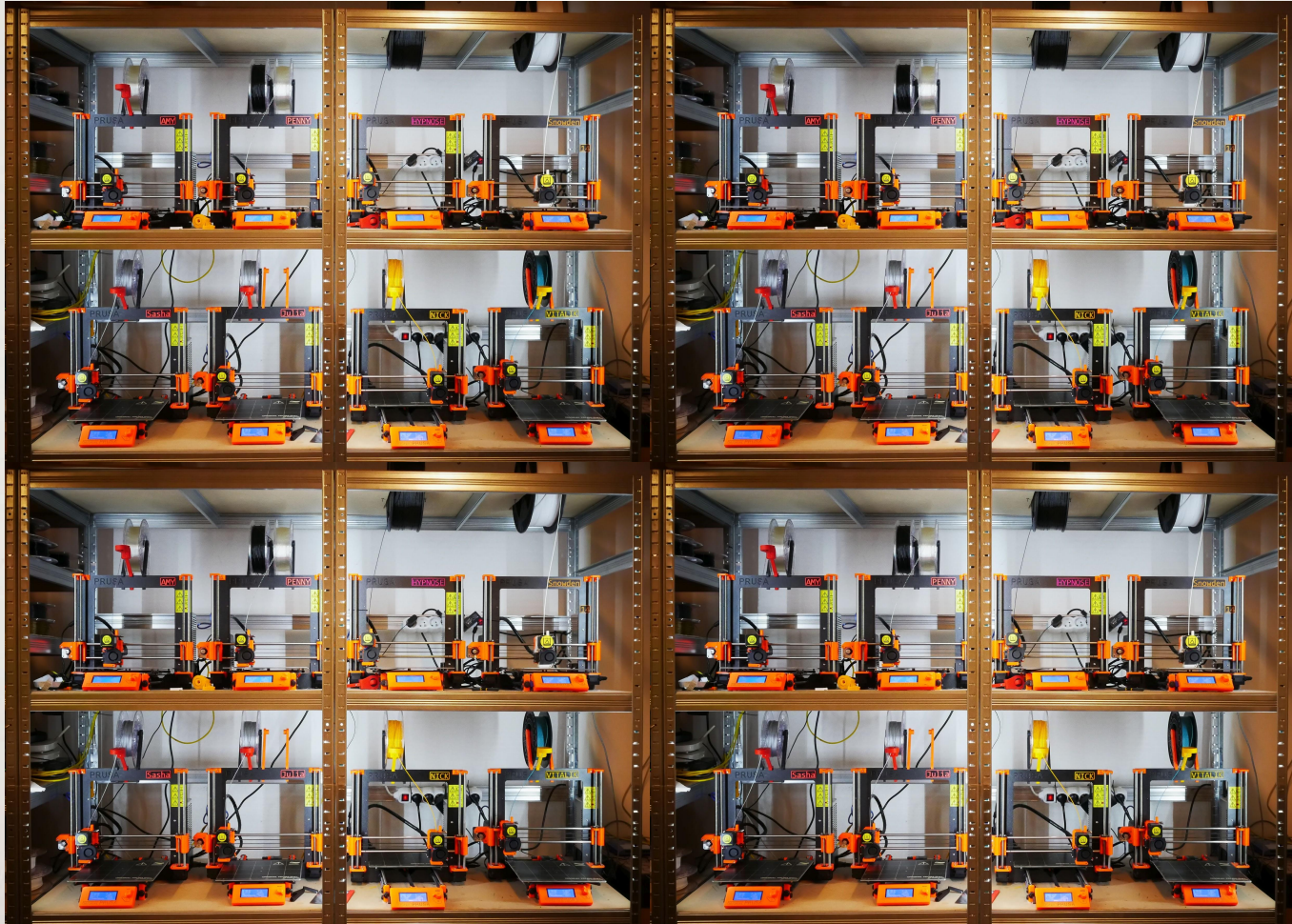


Tomáš Michálek
@qetak

Můj příběh

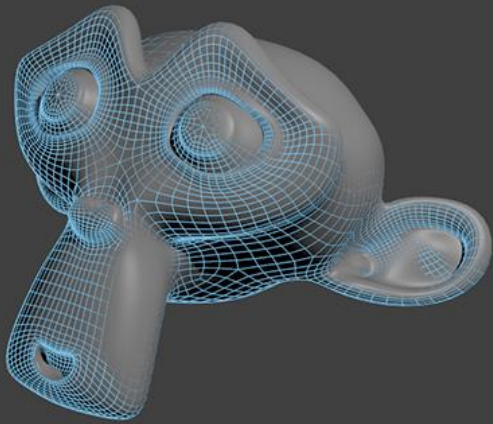


3D továrna



Rychlost a flexibilita výroby

Služby



3D modelování



3D tisk



Postprocessing

Malosériová výroba



Masky - StarWars



Masky - Cosplay



Harmonogram školení

ČTVRTEK

- I. Úvod do 3D tisku <10:00 - 11:15>
- II. Jak získat model pro tisk? <11:30 - 13:00>
- III. Modelovací nástroj Fusion <11:30 - 12:45>
- IV. Příprava modelů pro tisk <14:00 - 15:15>

PÁTEK

- V. Práce s tiskárnou <9:00 - 10:15>
- VI. OpenSCAD modelování/tisk <10:30 - 12:00>
- VII. Zaměřeno na školy a učitele <13:00 - 15:00>

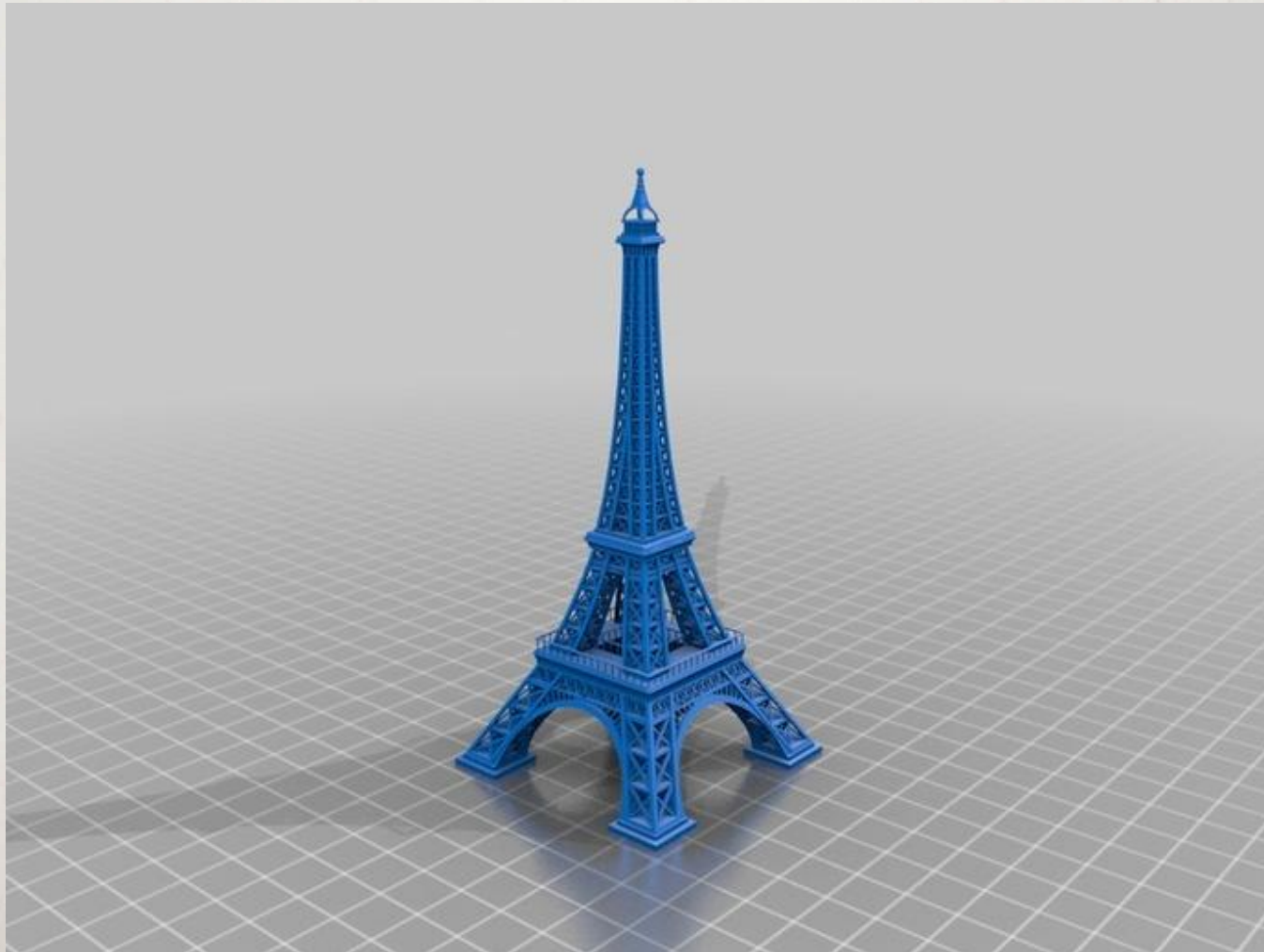
I. Úvod do 3D tisku

Proces, technologie, materiály

#PomahameTvorit

**Kdo má už nějaké zkušenosti s
3D tiskem?**

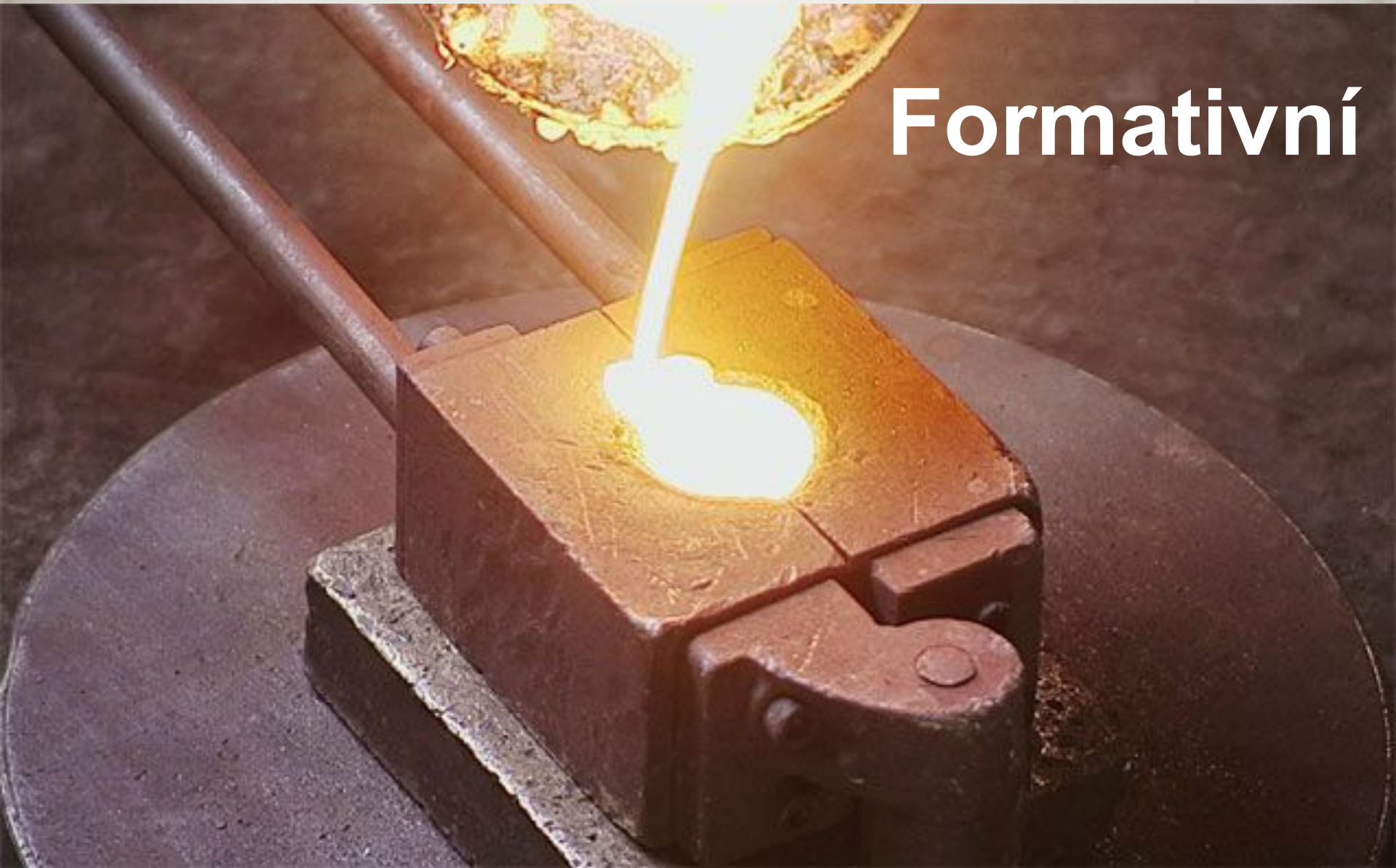
Z 3D modelu



... do fyzického objektu

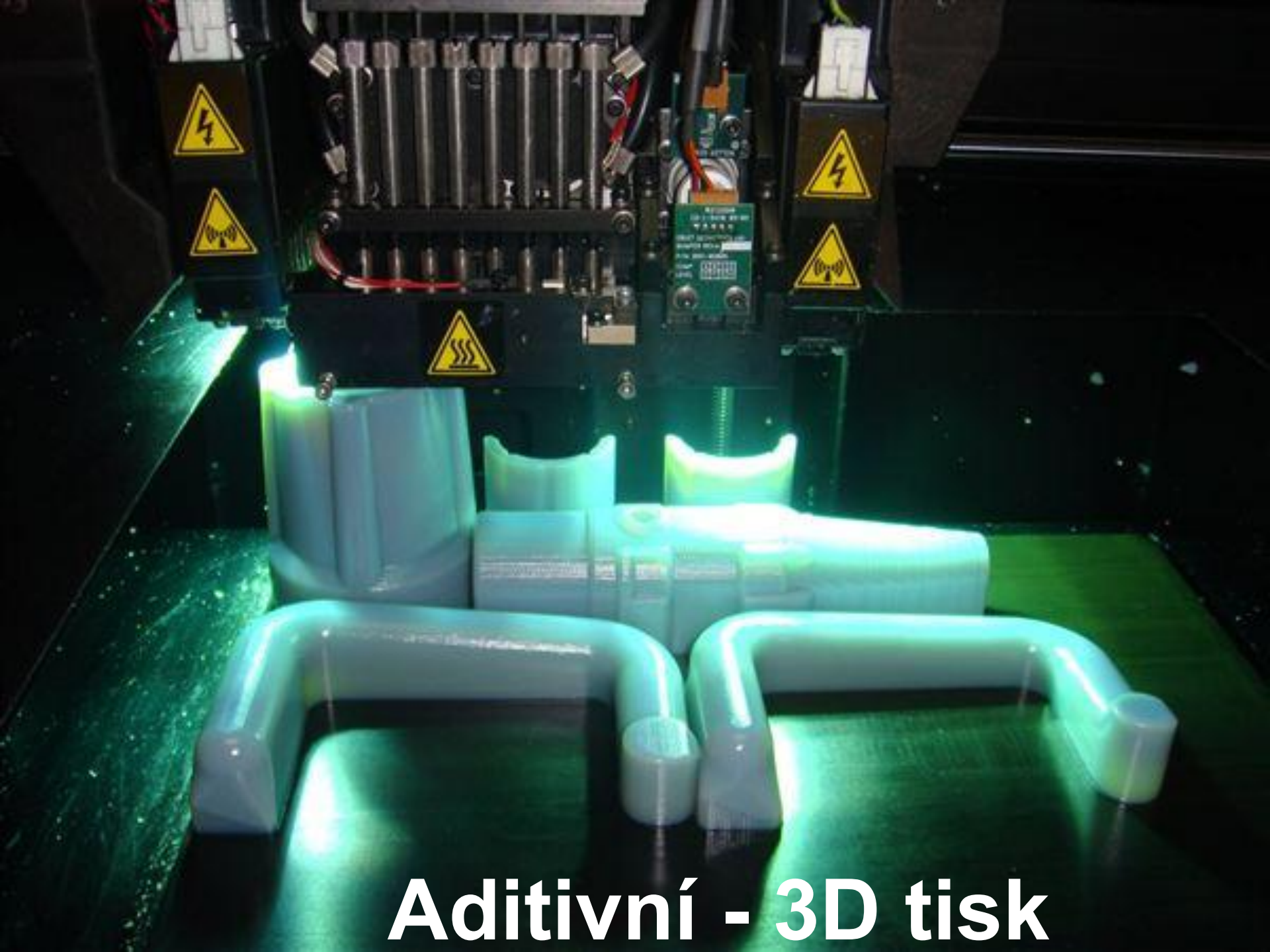


Formativní



Subtraktivní





Aditivní - 3D tisk

Proč se o 3D tisku tolik mluví?

Novinka?

'Revolutionary'

Machine makes 3-D objects from drawings

By Kathleen Sullivan
American-Statesman Staff

Wedged into the corner of an unused photo lab at the University of Texas is an ungainly machine that can transform a computer drawing into a three-dimensional model at the touch of a button.

Sometime next year, the machine, which was developed by a UT graduate student, will make its way out of the lab and into the commercial arena. It will leave with the blessing of the UT Board of Regents, which Thursday gave an Austin company exclusive licensing rights to the "revolutionary" new technology embodied in the machine.

The licensing pact paves the way for the first transfer of technology from the University of Texas at Austin to a commercial venture.

The company that won the right to market the invention is Nova Automation Corp., whose principal shareholders are an Austin consulting engineer and Nova Graphics International Corp., an Austin-based computer graphics software firm.

The agreement represents a "hard fought" victory for UT's fledgling Center for Technology Development and Transfer, said Meg Wilson, coordinator of the center, which was given life during the last Texas Legislature and got

See Inventor, A11



Staff photo by Ralph Barrera

Associate Professor Joe Beaman shows some three-dimensional plastic models made by the 'selective laser centering' device developed by Carl Deckard, left.

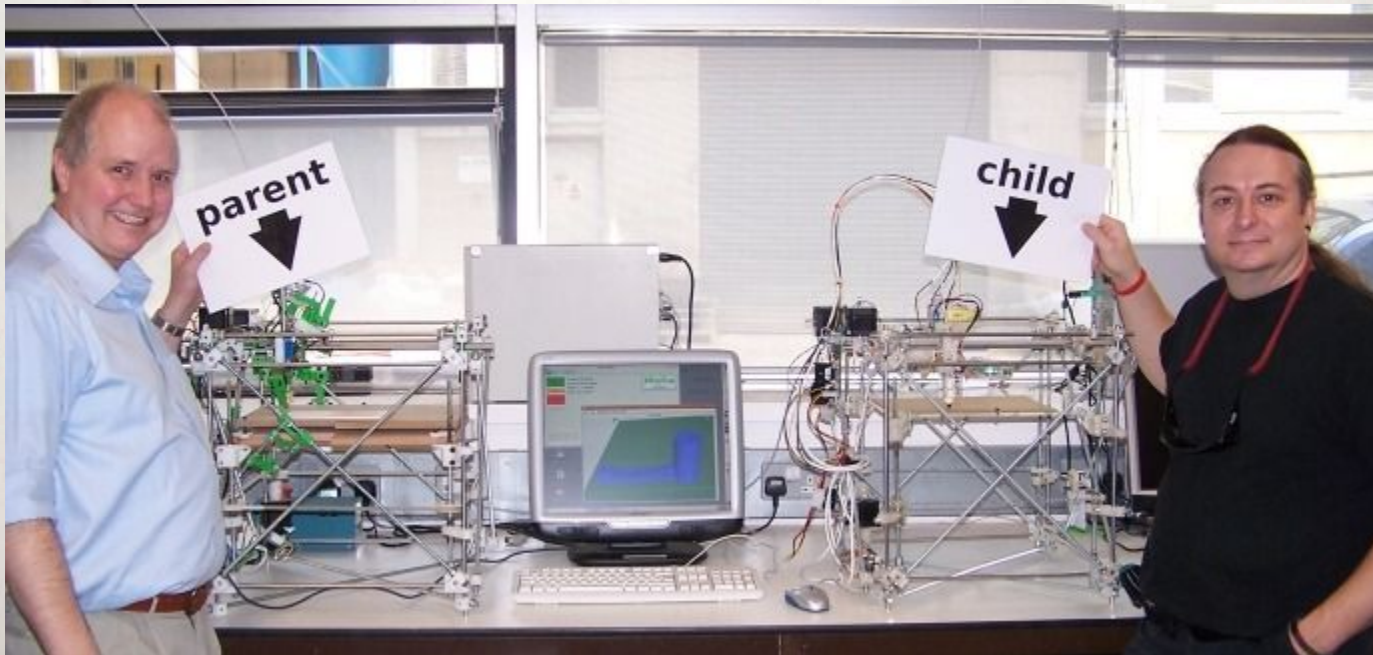
3D tisk je tady již 30 let

Vypršení patentů

Stolní 3D tiskárny

Ceny dolů

Reprap



Stolní vs průmyslové

stolní



průmyslová

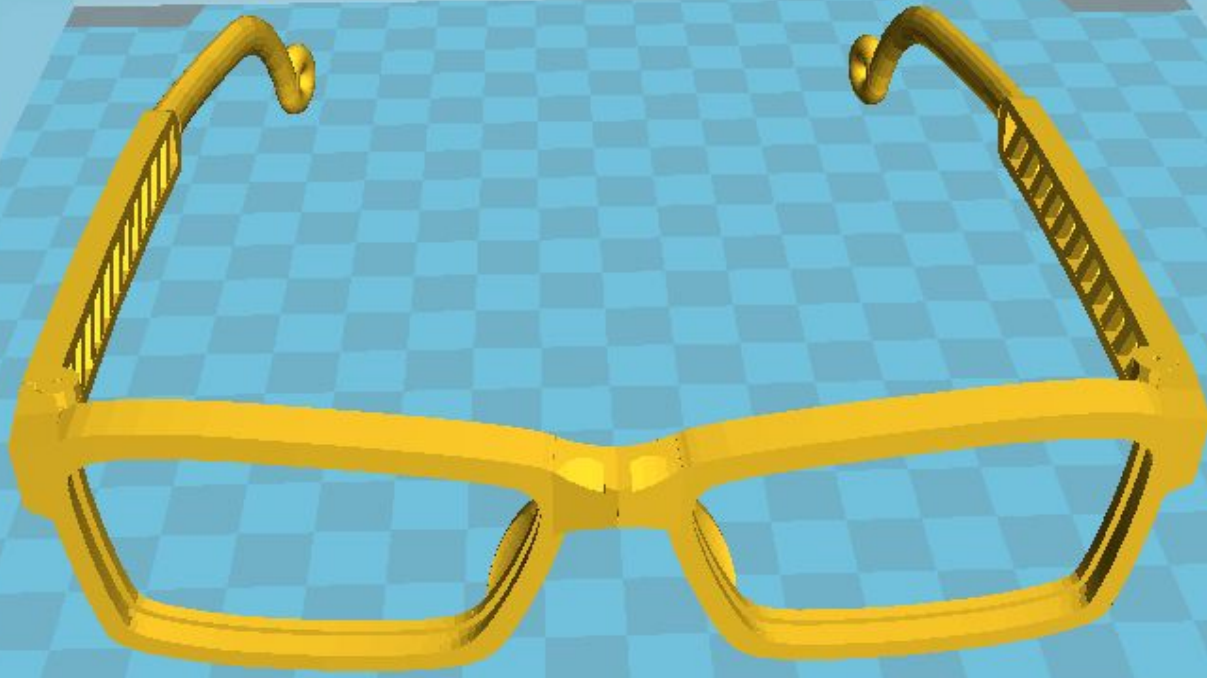


Jak 3D tisk vlastně funguje?

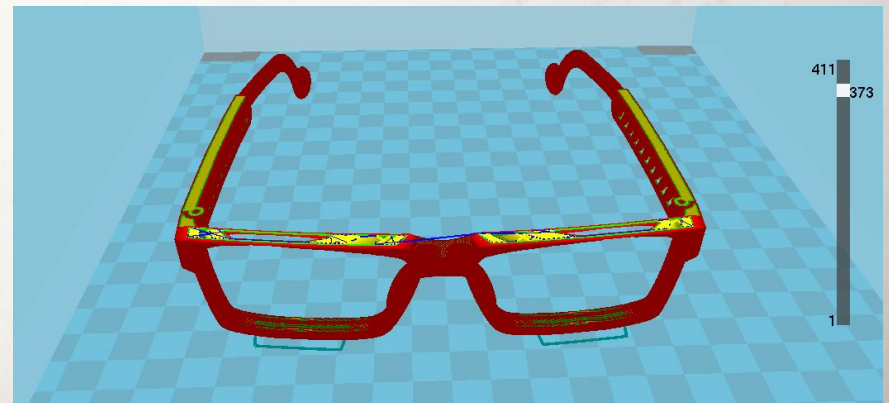
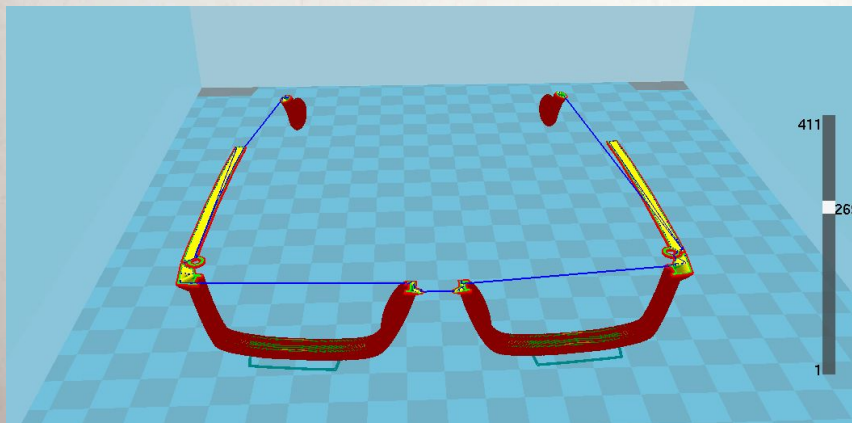
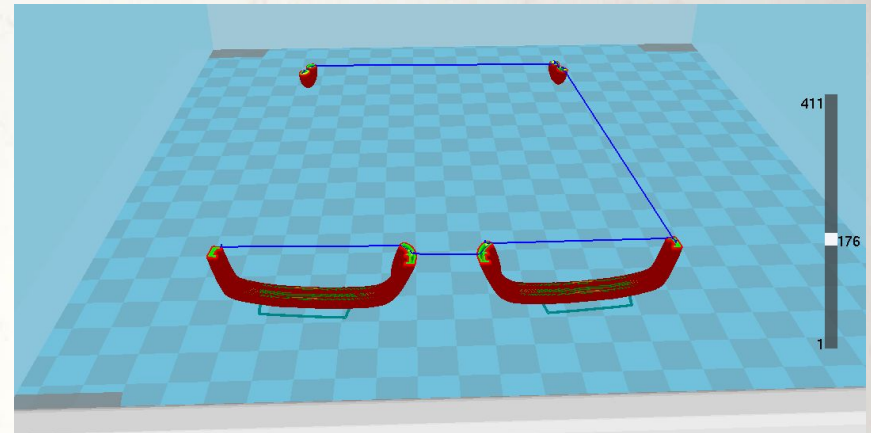
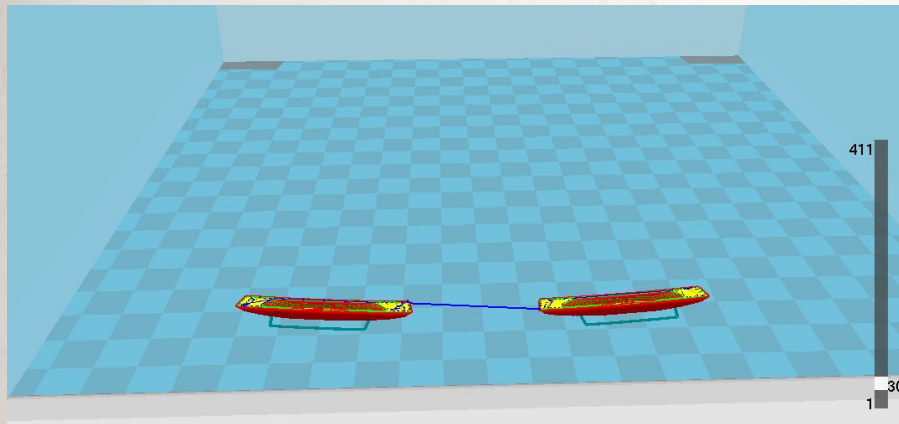
Proces tisku

- 1. design/modelování <STL>**
- 2. příprava pro tisk <GCODE>**
- 3. tisk**
- 4. (povrchová úprava)**

Zpracování modelu



Zpracování modelu



Technologie 3D tisku

3D tiskové technologie

ADDITIVE MANUFACTURING TECHNOLOGIES



Find out more at www.3dhubs.com/what-is-3d-printing

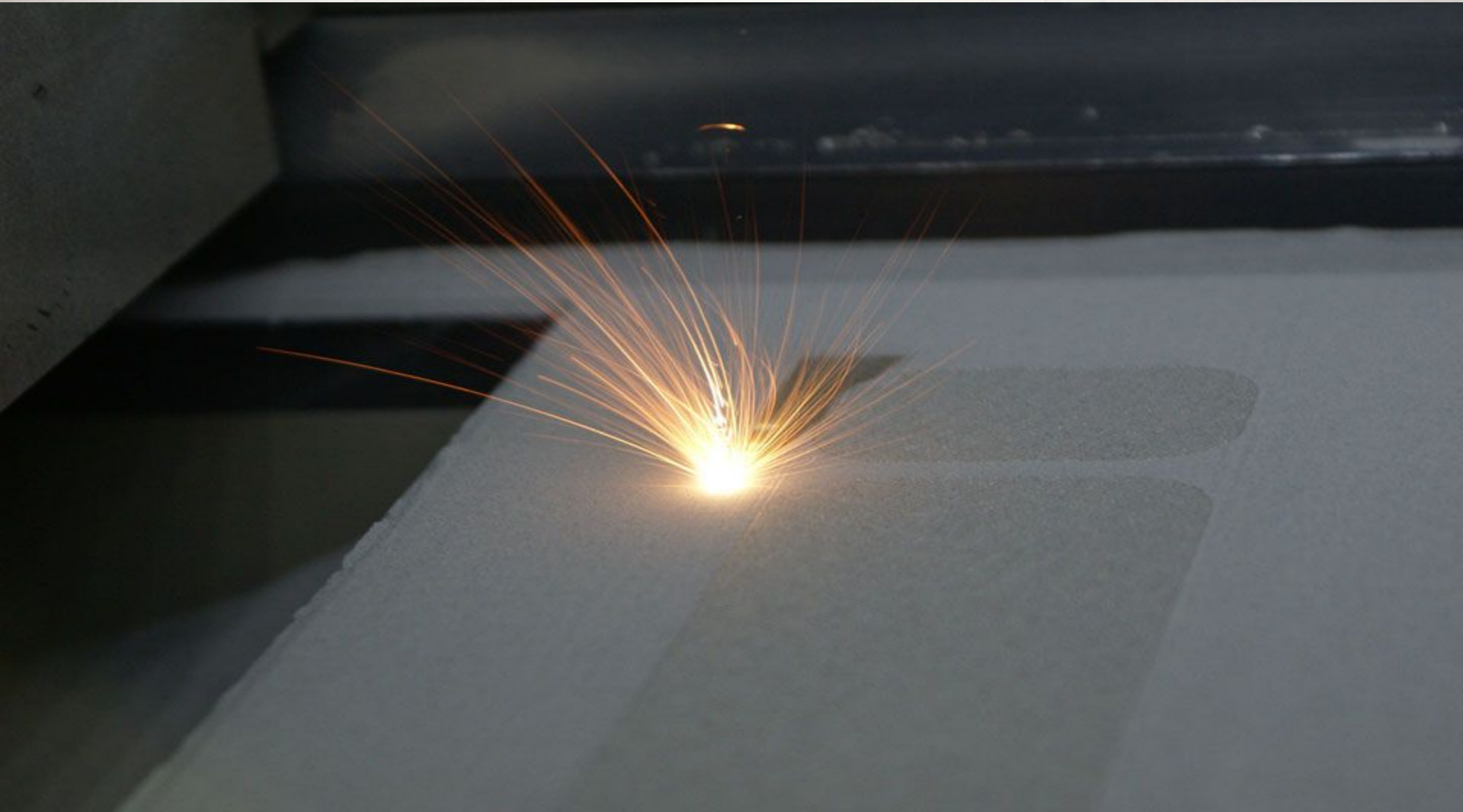


<https://www.3dhubs.com/get/am-technologies>

Vytlačování termoplastu - FDM



Slinování laserem - SLS



Stereolitografie - SLA



Materiály 3D tisku

Filament

**Termoplasty: ABS, PLA, PET, nylon, PC,
dřevěné plnivo, flex...**



<https://www.prusa3d.cz/materialy/>

Prusa Multimaterial



Resin



Polyamid - nylon



Kovový prášek



II. Jak získat model pro tisk?

Vytvoříme první 3D modely

#PomahameTvorit

Databáze modelů



Run The Jewels



Cosplay



3D Hubs



Molecular



Camping



Dad



Apple Watch



Pebble

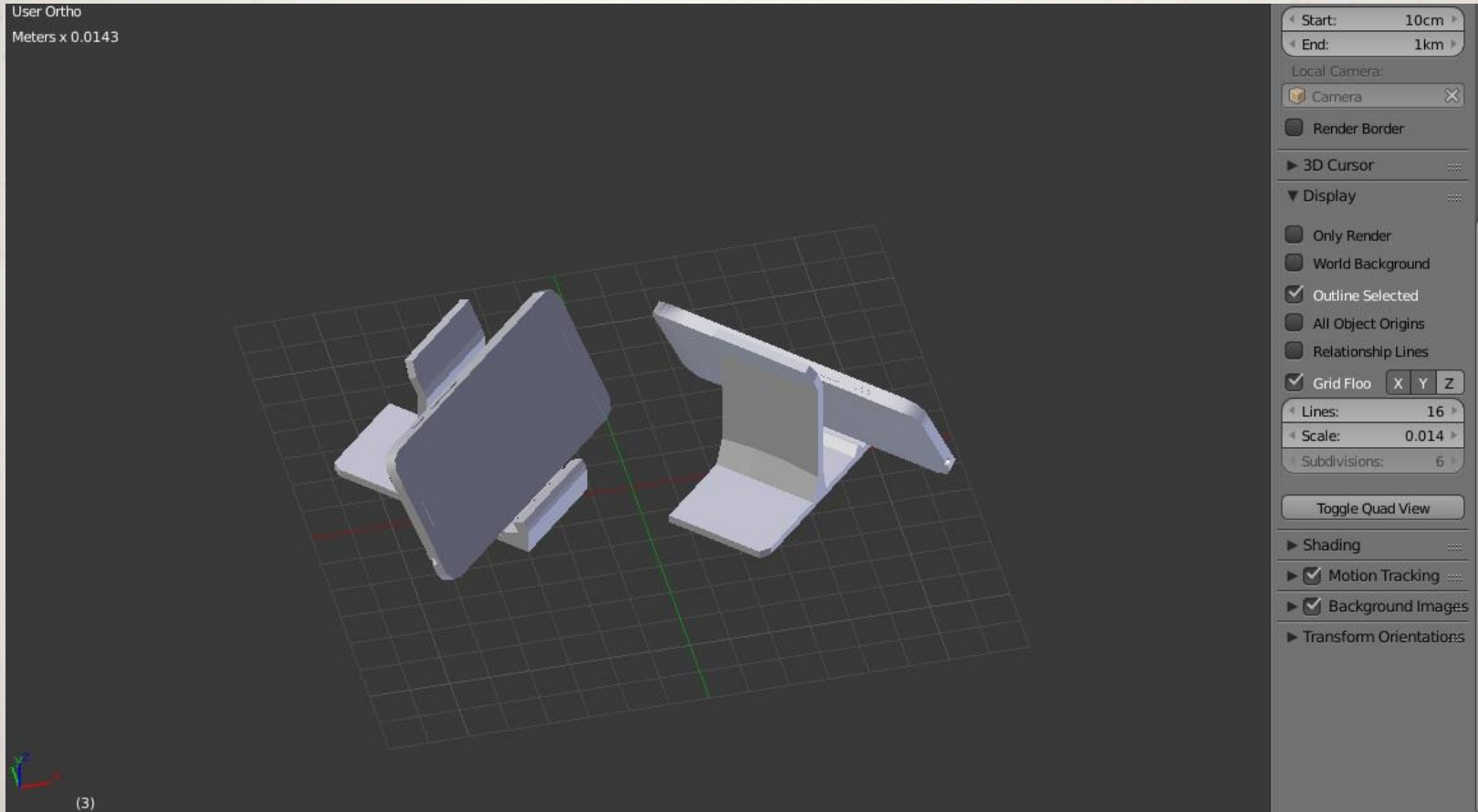
MakersLab modely - zdarma

The screenshot displays the profile of 'Makerlab Paralelni Polis' on the MakersLab platform. The profile includes a header image of various 3D-printed vases, a yellow circular logo with a black 'M' and 'L' symbol, and the text 'Makerlab Paralelni Polis' with the handle 'makerslabcz' and location 'Prague'. Below this is a green 'FOLLOWING' button and a blue 'TIP DESIGNER' button. The profile statistics are: 76 FOLLOWERS, 75 FOLLOWING, 102 DESIGNS, and 4 COLLECTIONS. At the bottom of the profile section, it shows 8 and 28. To the right, there are navigation tabs: ABOUT, DESIGNS, COLLECTIONS, MAKES, and LIKES. Below these are filters for 'POPULAR' and 'FILTER', and a search icon. The main content area shows a grid of four 3D model designs:

- Medallion - Witcher Wolf - La...** by makerslabcz, Jul 29, 2015. 151 likes, 167 views, 0 comments.
- Wolf head** by makerslabcz, May 23, 2016. 67 likes, 61 views, 0 comments.
- Predator Shoulder Cannon** by makerslabcz, Jul 13, 2016. 65 likes, 62 views, 3 comments.
- Gengar Low-poly Pokemon** by makerslabcz, Jul 20, 2016. 59 likes, 79 views, 2 comments.

<http://www.thingiverse.com/makerslabcz/designs>

3D modelování



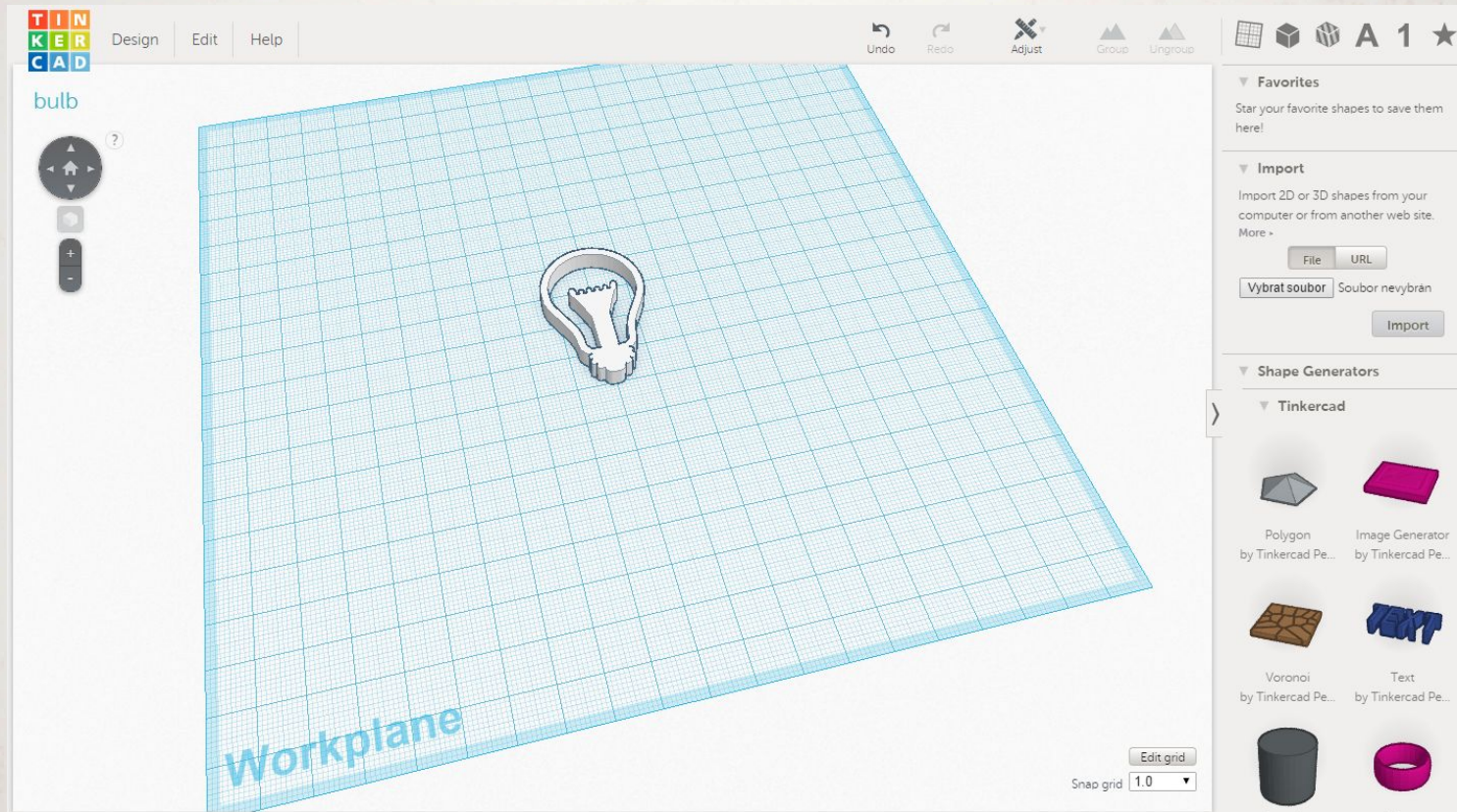
<https://www.blender.org/>

3D skenování



skenování geometrie povrchu objektu

Pojďme vytvořit první model



<https://www.tinkercad.com/>

Typy modelování

Sochařina (Sculpting)

Parametr (funkce a polygon)

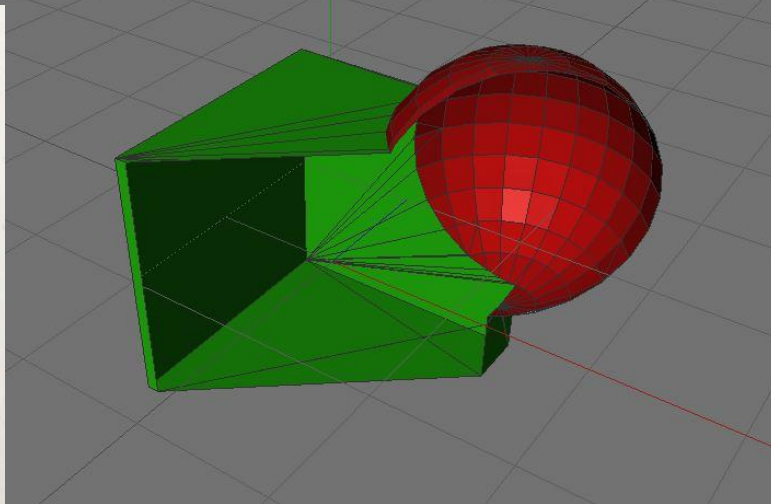
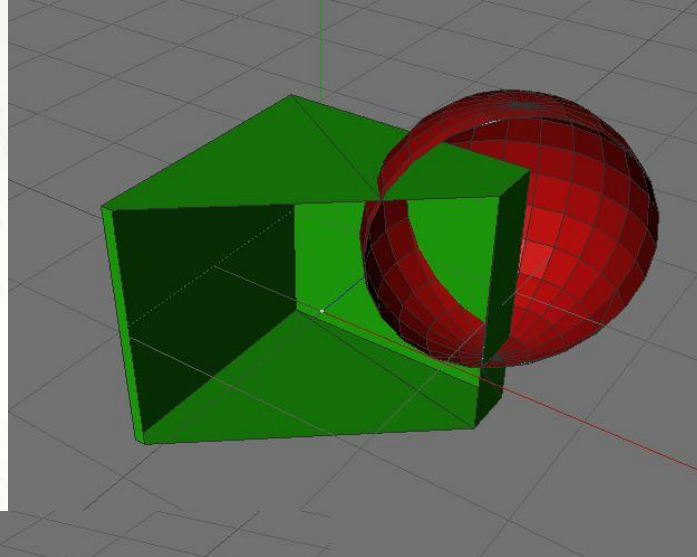
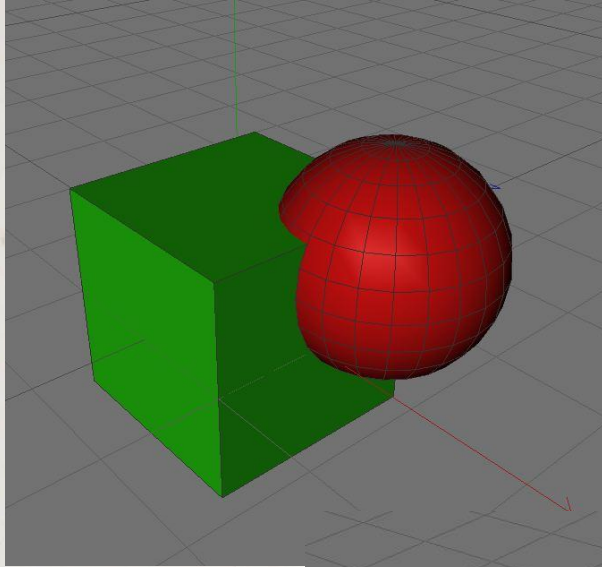
Matematické (vzorce)

Modelování (klasické)

Oprava STL modelů

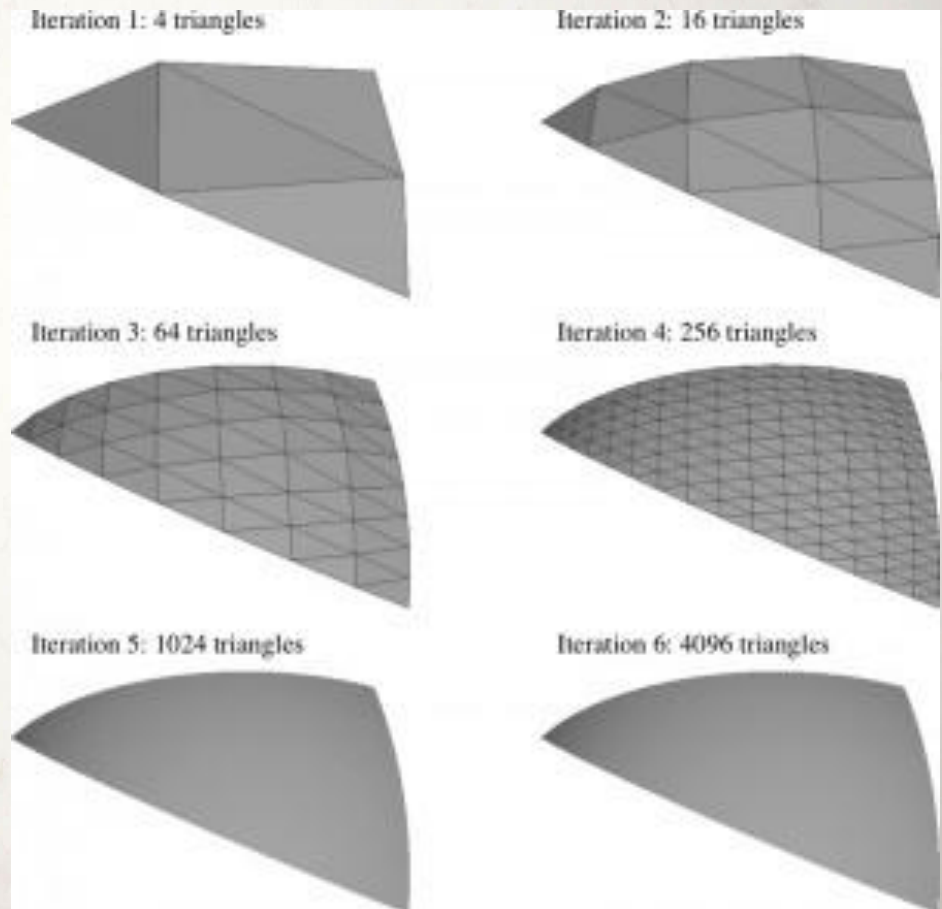
- * **Watertight**
- * **Wall thickness analysis**
- * **Wall clearance analysis**
- * **Gaps, Holes**
- * **Non manifold components**
- * **Self intersections**
- * **Duplicate triangles/vertices**
- * **Duplicate vertices**
- * **Disconnected parts**

Manifold



Detail vs velikost

- Kam až mohu zajít
- Co mi stačí?
- Co zvládne PC?



III. Modelovací nástroj Fusion

#PomahameTvorit

Fusion 360

Parametrické modelování

Lze vložit designy z Eagle

Autodesk produkt

Potřeba vytvořit autodesk účet

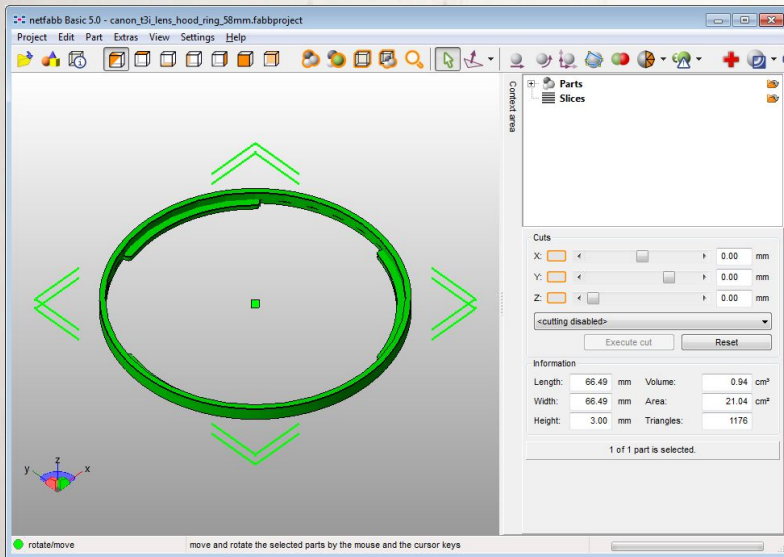
Zdarma pro učitele a studenty

<https://www.autodesk.com/products/fusion-360/students-teachers-educators>

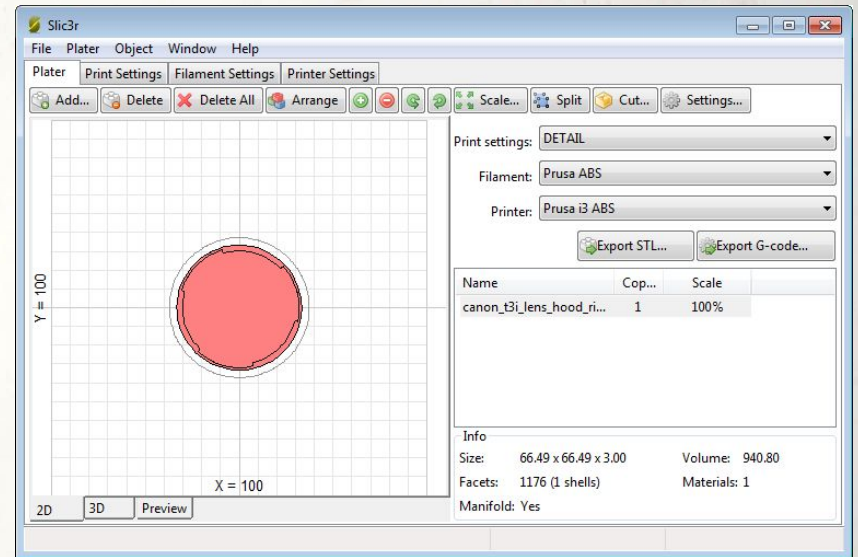
IV. Příprava modelů pro tisk

#PomahameTvorit

Příprava modelů pro tisk



kontrola



slicer

Slicery

**Software pro zpracování modelů pro tisk - “nařeže” model na vrstvy
Vkládám STL a generuji GCODE,
který tiskárna umí zpracovat**

[Slic3r](#)

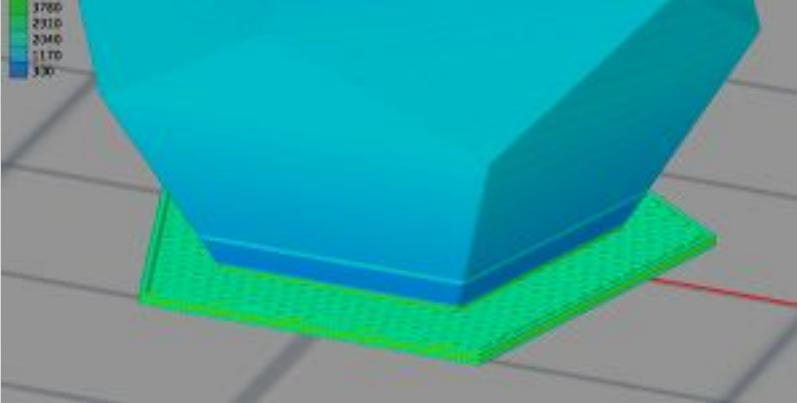
[Slic3r - Prusa Edition](#)

[Simplify3D](#)

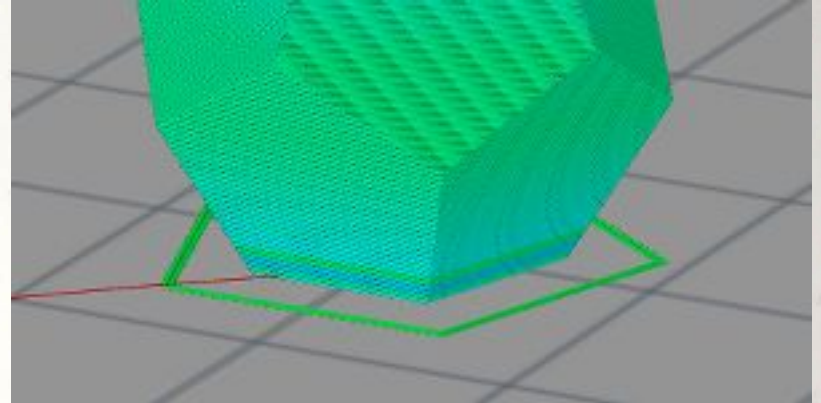
[Cura](#)

[KissSlicer](#)

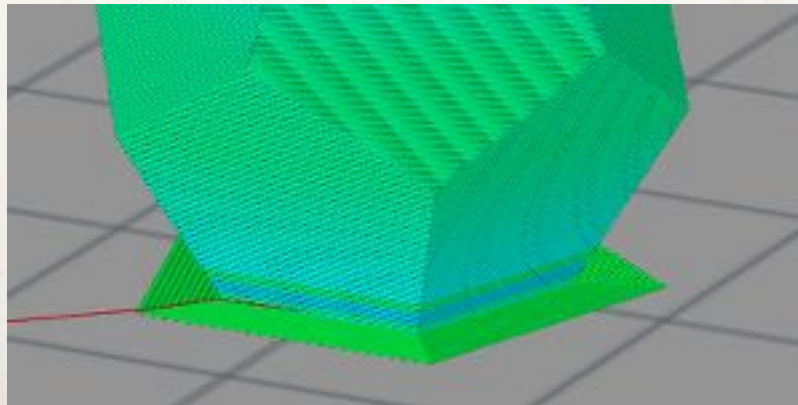
Skirt, Raft, Brim



raft



skirt



brim

VII. Zaměřeno na školy, učitele a žáky

#PomahameTvorit

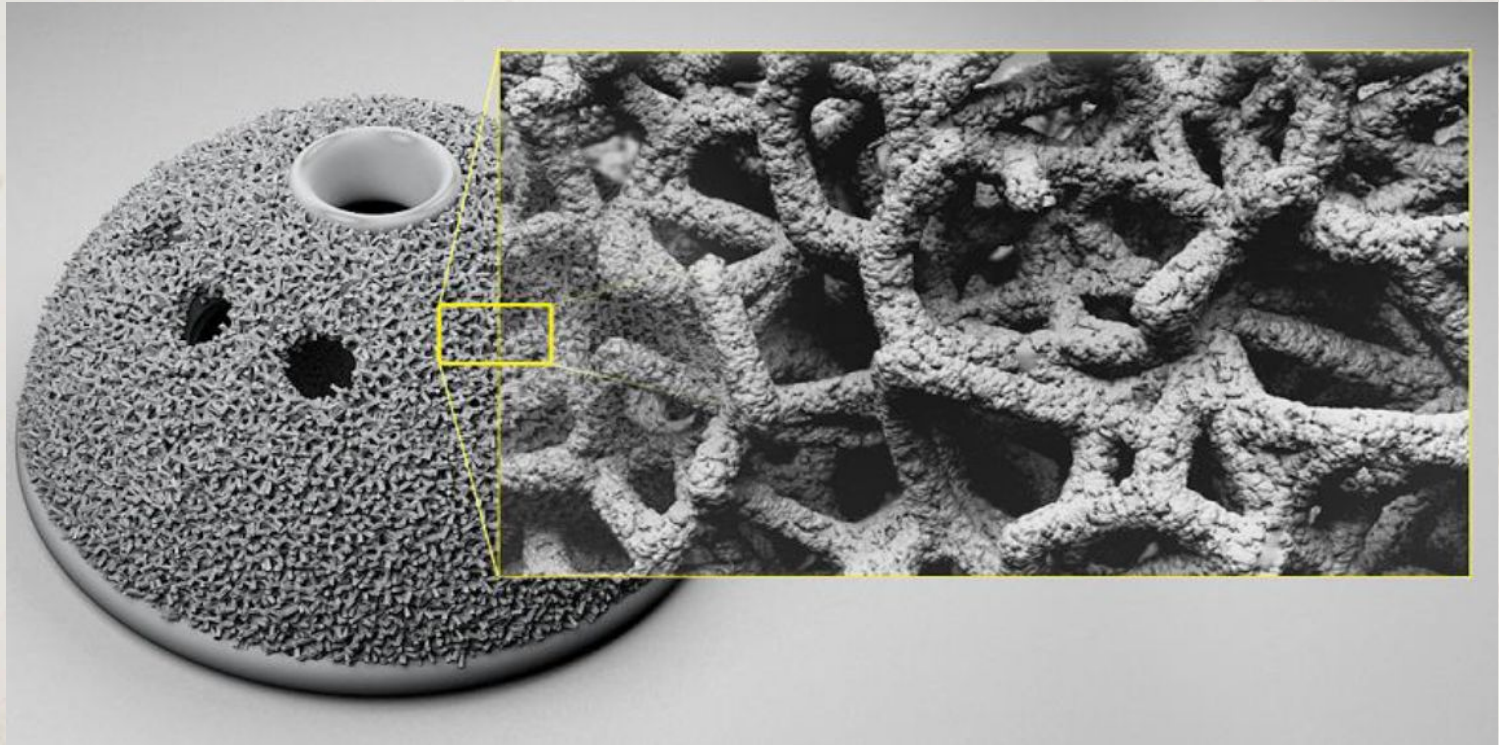
Proč tisknout věci na 3D tiskárně?

Rychlost výroby a inovace



Speed to market - výroba v řádu jednotek dní

Komplexní tvary



**Tvary, které nelze vyrobit tradičními metodami.
Cena zůstává stejná - nezávislá na složitosti tvaru**

Masová personalizace



**Každý kus je jiný
... za stejnou cenu**

Odpadá montáž

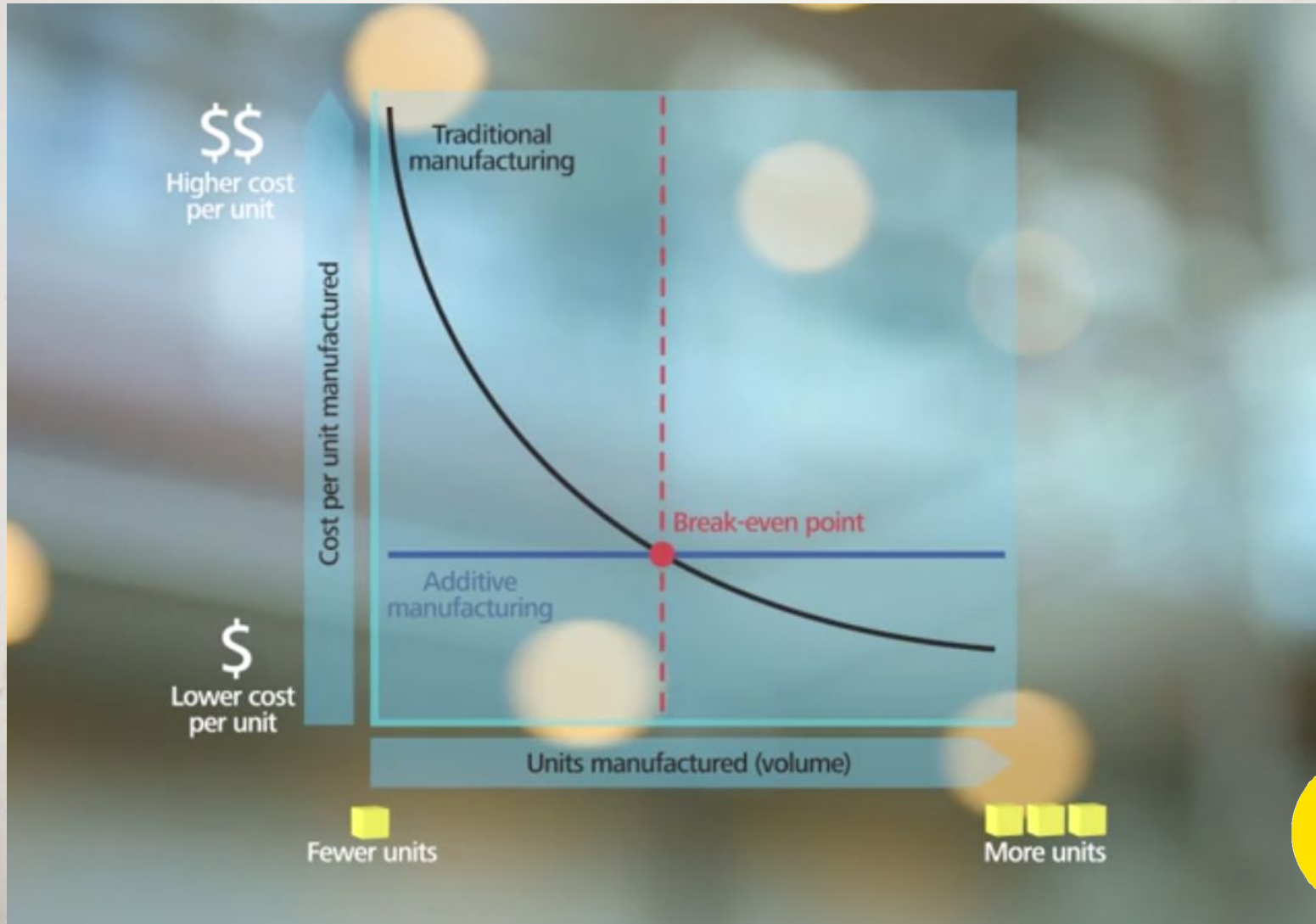


**1320 smontovaných dílů
Vytisknuto jako jeden celek**

Využití 3D tisku dnes



Tradiční vs 3D tisk (aditivní)



Odkud čerpat informace?

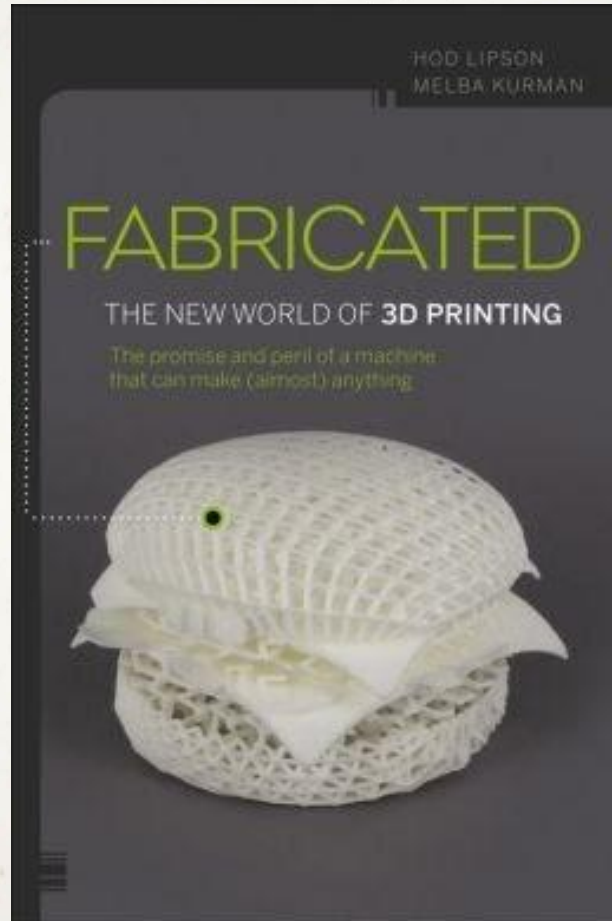
Facebooková komunita - 3D tisk

The image shows a screenshot of the Facebook group page for '3D tisk'. The page is displayed on a mobile device, as evidenced by the navigation bar at the top with the user's name 'Tomas' and icons for Home, Create, and notifications. The group name '3D tisk' is visible in the top left corner of the page. The main content area features a large image of a hand holding a smartphone that displays a 3D printed gear mechanism. Below the image, there are buttons for 'Joined', 'Notifications', 'Share', and 'More'. The post creation area includes options for 'Write Post', 'Add Photo/Video', 'Live Video', and 'More'. A text input field with the placeholder 'Write something...' is visible. On the right side, there are sections for 'CATEGORIZE POSTS' with a '+ Create Topic' button, and 'ADD MEMBERS' with an 'Embed Invite' button and a search input field. The left sidebar contains navigation options such as 'About', 'Discussion', 'Announcements', 'Members', 'Events', 'Videos', 'Photos', 'Files', 'Group Insights', and 'Moderate Group'. There is also a search bar for the group and a 'Shortcuts' section with links to 'Open Innovations Tým (...)', '3D modelování - 3D ...', and 'Makerslab drom'.

<https://www.facebook.com/groups/3dtisk/>

Literatura

Knaha - Hod Lipson: Fabricated



<http://www.amazon.com/Fabricated-The-New-World-Printing/dp/1118350634>

Průša ebook





<https://www.prusa3d.cz/kniha-zaklady-3d-tisku-josefa-prusi/>

Průša manuály

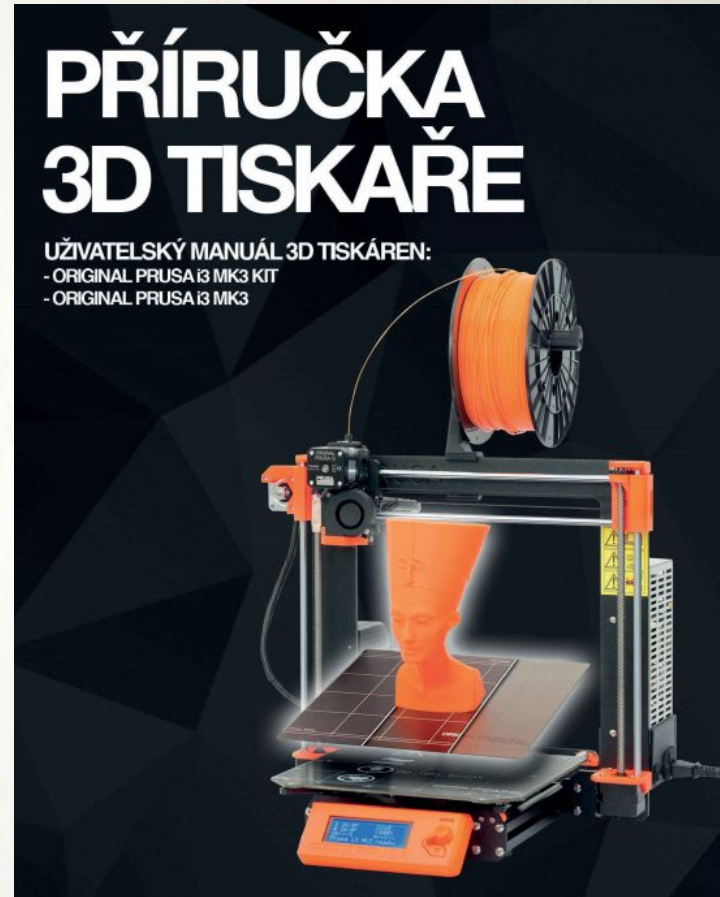


Manuály v češtině
Manuály v češtině pro Original Prusa i3 3D tiskárnu

7 Kategorie


 EN Jak sestavit Original Prusa i3 MK2S v2.05	 EN Original Prusa i3 MK2 na MK2S upgrade	 EN Jak sestavit Original Prusa i3 MK3 v3.05	 EN Original Prusa i3 MK2/S na Multi Material upgrade	 EN Original Prusa i3 MK2S na MK2.5 upgrade v2.52
 EN Original Prusa i3 MK2S na MK3 upgrade	 EN Prusa starší návody			

How-to Guides



PŘÍRUČKA 3D TISKAŘE

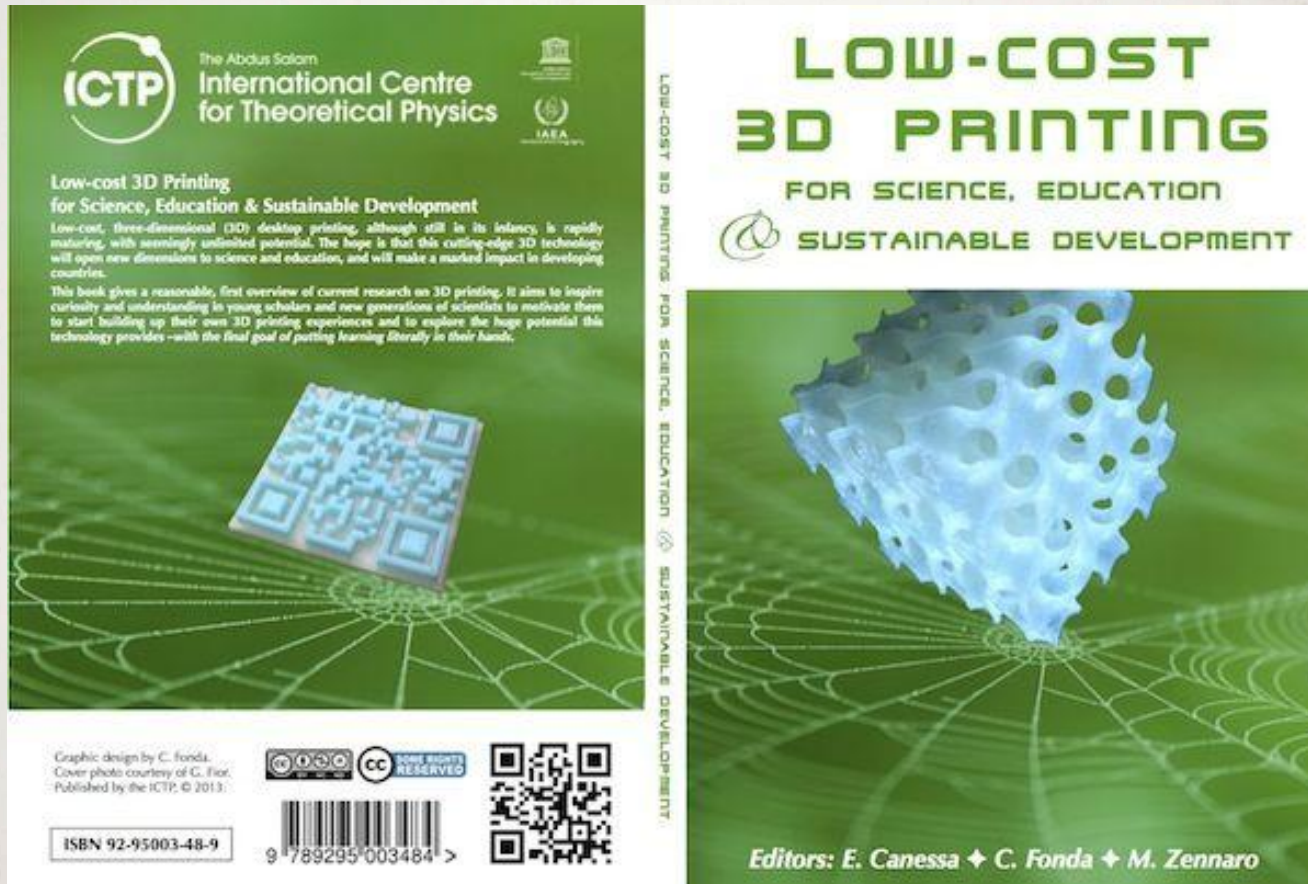
UŽIVATELSKÝ MANUÁL 3D TISKÁREN:
- ORIGINAL PRUSA I3 MK3 KIT
- ORIGINAL PRUSA I3 MK3



https://manual.prusa3d.com/c/Manuály_v_češtině

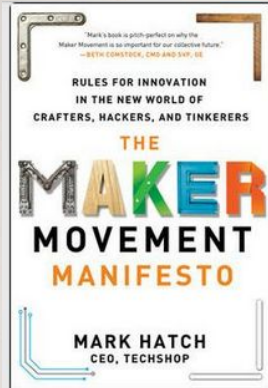
http://prusa3d.com/downloads/manual/prusa3d_manual_mk3_cz_3_03.pdf

Open Book: Low-cost 3D printing



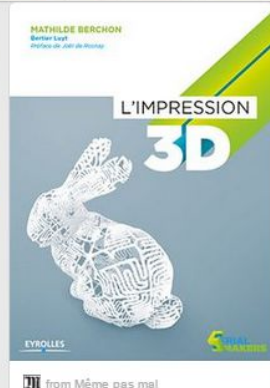
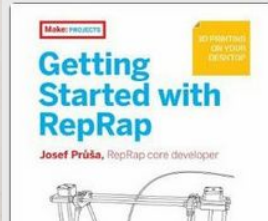
<http://sdu.ictp.it/3D/book.html>

Další knížky



The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers by Mark Hatch

Pinned from meducation.asia

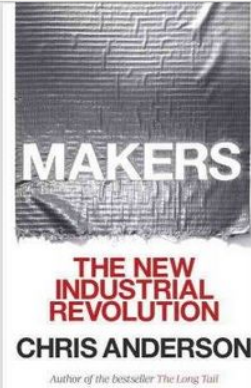


from Mème pas mal

Tout savoir sur l'impression 3D en 200 pages papier

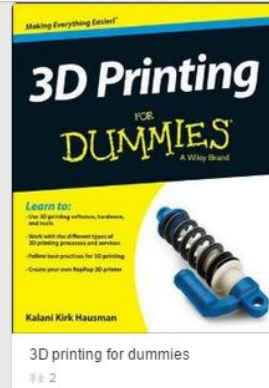
impression 3D avec liens vers sites

Pinned from alternatives.blog.lemonde.fr



Makers : the new industrial revolution

Pinned from catalog.kentonlibrary.org



3D printing for dummies

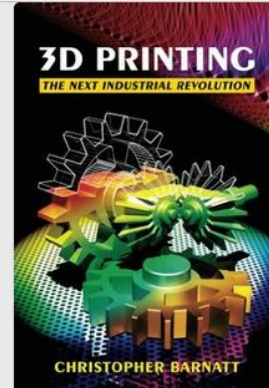
2

Pinned from amazon.com



Open Book on "Low-cost 3D Printing for Science, Education and Sustainable Development"

Pinned from sdu.ictp.it



3D Printing: The Next Industrial Revolution

Pinned from 3d-printing-today.blogspot.com

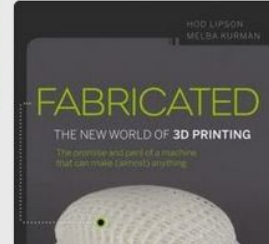


FUTURE FACTORIES AND HOW TO CAPITALIZE ON DISTRIBUTED MANUFACTURING

By Christopher D. Winnan

3D Printing: The Next Technology Gold Rush - Future Factories and How to Capitalize on Distributed Manufacturing

Pinned from geniusebook.com



<https://www.pinterest.com/3dtisk/knihy-3d-tisk/>

3D Hubs - 3D printer Guide

Hodnocení tiskáren dle uživatelů

<https://www.3dhubs.com/best-3d-printer-guide>

3D printing Handbook

<https://www.3dhubs.com/3d-printing-handbook>



You Tube

Youtubeři o 3D tisku

Průša - <https://www.prusa3d.cz/video-jak-pouzivat-tiskarnu/>

Thomas Sanladerer -

<https://www.youtube.com/user/ThomasSanladerer>

3D printing nerd -

<http://the3dprintingnerd.com/>

3D Maker Noob -

<https://3dmakernoob.com/>

a mnoho dalších...

<https://all3dp.com/1/best-youtube-channels-3d-printing/>

VIDEO JAK POUŽÍVAT TISKÁRNU



Original Prusa i3 MK3 – Návod pro nové uživatele (CZ titulky)



Testování bezpečnostních prvků na Original Prusa i3 MK3 (CZ titulky)

Youtubeři o 3D modelování

Fusion 360

<https://www.youtube.com/channel/UCiMwMz3RMbW5mbx0iDcRQ2g>

OpenSCAD

Paul Randall - 3DPrinting4EDU

<https://www.youtube.com/channel/UCnxMaGMCrWAQgwF61ISRpGw/featured>

DIY3Dtech

<https://www.youtube.com/channel/UCNfTwYpWGkDcGhvzj4RoRhQ>

3D pro školy

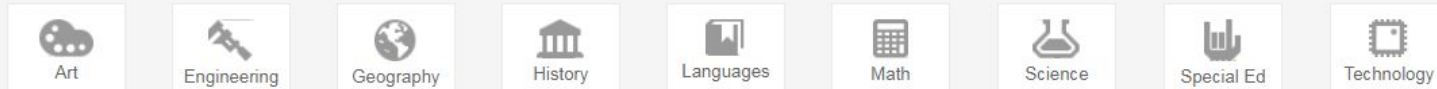
Thingiverse Education

THINGIVERSE EDUCATION

Thingiverse Education provides over a hundred free lessons that make teaching with a 3D printer easier and more effective for a variety of grade levels and subjects. It also provides a community where educators can exchange best practices or remix projects.

BROWSE EDUCATIONAL PROJECTS

BY SUBJECT



BY GRADE



BY COLLECTION



<https://www.thingiverse.com/education>

MakerBot - Příručka pro učitele



<https://www.makerbot.com/education/3d-printing-guidebook/>

http://pages.makerbot.com/rs/444-ZTM-866/images/MakerBot_Educators_Guidebook_vf2.pdf

Využití ve škole

30
YEARS

3D printers have actually been around for about 30 years. Barriers like cost are breaking down, so they're now becoming available to the public.



Printed objects can be incredibly intricate. They can also be created with working components, hinges, and parts within parts.

Biology students can study cross-sections of hearts or other organs.



REVOLUTIONIZING

the

CLASSROOM



Engineering and design students can print out prototypes of their creations.

Chemistry students could print out molecules to study.



3D printing has caught the attention of educators who are looking into ways to incorporate it into the classroom.



Architecture students could easily print out 3D models of their designs.

Auto class students could print replacement or modified car parts.



Using 3D printers in the classroom could mean:



History classes could print out historic artifacts for closer examination.

Cooking class students could design intricate molds for ices and gelatins.



Graphic design students could create 3D versions of their artwork.

Students in geography courses could print out maps showing the topography, population or demographics of an area.

Vzdálený tisk octoprint

- SW umožňující vzdálený tisk a ovládání tiskáren při jejich připojení do počítačové sítě
- Lze nainstalovat na RaspPi - připojení do sítě a přes USB na tiskárnu
- Užitečné pluginy - historie tisků atd.

www.octoprint.org

<https://plugins.octoprint.org/>



Octopi Camera

The screenshot displays the OctoPrint web interface. At the top, the OctoPrint logo is on the left, and navigation links for Settings, System, and user 'john' are on the right. The main content area is divided into several sections:

- Connection:** Shows the printer's IP address: BL-16-05-31-03-025-024 at /dev/ttyACM1.
- State:** Displays the printer's status: Machine State: Printing. File: KitchenaidAccessoryHolder2.gco. Timelapse: -. Filament (Tool 0): 1.58m / 3.80cm³. Approx. Total Print Time: 01:28:24. Print Time: 00:16:42. Print Time Left: an hour. Printed: 17.2KB / 1.4MB. Below this are buttons for Print, Pause, and Cancel.
- Files:** A list of files with a search bar. The first file is 'KitchenaidAccessoryHolder2.gco', uploaded 14 hours ago, with a size of 1.4MB. The second file is 'KitchenaidAccessoryHolder2.stl', also uploaded 14 hours ago, with a size of 100.3KB.
- Control Panel:** A large video window showing a top-down view of the printer's nozzle printing a blue object. Below the video are three tabs: Movement, Extruder, and General.

Gina Häußge - Patreon - <https://www.patreon.com/foosel>

Vzdálený tisk octoprint

The screenshot displays the OctoPrint web interface. At the top, there's a navigation bar with 'OctoPrint', 'Settings', 'System', and a user profile 'foosel'. The main content is divided into several sections:

- Connection:** Shows signal strength and connection status.
- State:** Displays machine status as 'Printing'. File: 'CuteOcto.gco'. Timelapse: 'Timed (2 sec)'. Filament (Tool 0): '2.22m'. Approx. Total Print Time: '00:44:04'. Print Time: '-'. Print Time Left: '44 minutes'. Printed: '5.2KB / 2.0MB'. Below this are 'Print', 'Pause', and 'Cancel' buttons.
- Files:** A list of files with a search bar. The files listed are:
 - CuteOcto.gco**: Uploaded: 5 days ago, Size: 2.0MB
 - Webcam_cover_-_Part_1a.gcode**: Uploaded: 10 days ago, Size: 1.1MB
 - Webcam_cover_c920.gco**: Uploaded: 10 days ago, Size: 1.2MB
- Temperature Control:** A graph showing temperature over time. The y-axis ranges from 0 to 300. The x-axis shows a time interval of -1 min. A red line represents the 'Actual T: 209.0°C' and a horizontal line represents the 'Target T: 210.0°C'. A green octopus watermark is visible in the background of the graph.
- Temperature Control Table:** A table with columns for 'Actual', 'Target', and 'Offset'. The 'Actual' value is 209.0°C. The 'Target' is set to 210 °C. The 'Offset' is 0 °C.

Gina Häußge - Patreon - <https://www.patreon.com/foosel>

Vzdálený tisk v 3D továrně



FarmServer <https://github.com/MakersLab/Farm-server>
FarmClient <https://github.com/MakersLab/farm-client>

A close-up photograph of a wooden spiral, possibly a decorative element or a piece of art. The wood grain is clearly visible, showing concentric rings. The spiral is the central focus of the image.

Děkuji!

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