



TRANSNATIONAL PROJECT
MEETING ON
IMPLEMENTATION OF STUDY
COURSE DEVELOPMENT IN
METAL INDUSTRY

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**IMPLEMENTING
INTERDISCIPLINARITY IN CAREER
COUNSELING**

 Funded by the
Erasmus+ Programme
of the European Union

„Sissejuhatus tänapäeva
tootmisesse“

Esmaspäev, 01. oktoober 2018
kuni Reede, 05. oktoober 2018

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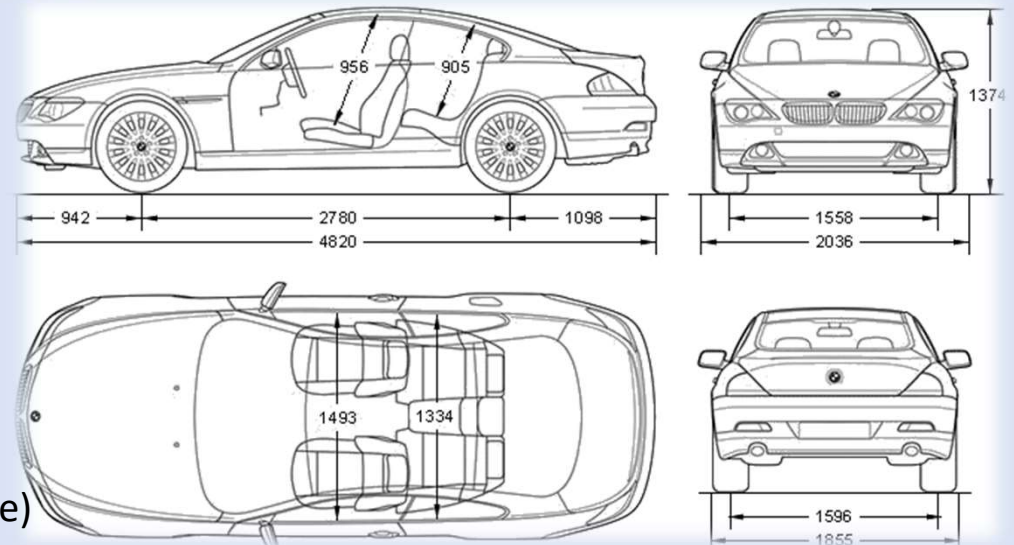
Teaching course structure for Metal and Machinery industry

- Idea generation and product design (Idee ja Disain)
- Technologies (Tehnoloogiad)
- Cutting ex. stamping (Lõiketöötlus nt. Stantsimine)
- Plastic injection molding (Plast ja survevalu)
- Assembling (Automaat koostamine)
- Heat treatment (Termotöötlus)
- 3D printing
- Economic Calculation
- PRACTICAL ASSIGNMENT WITH SCHOOL CHILDREN
(<https://www.merkuur.eu/>)

Engineering Design (Tehniline disain)



Priit Põdra



<https://www.youtube.com/watch?v=8z-iebHRxJk> (3D printed home)

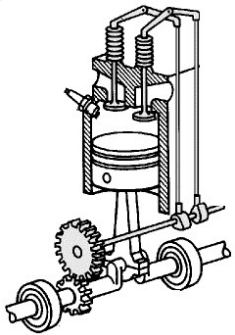
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<https://www.youtube.com/watch?v=5rrpQnnGC6E> (Metal 3D Printing)

Mechanical Engineering Challenges (Masinaehituse väljakutsed)

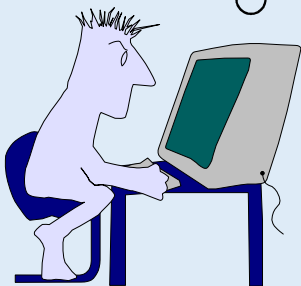


Does the structure correspond to **REQUIREMENTS**?

Is the structure adequately **RELIABLE**?

Is the structure adequately **SAFE**?

If some product or thing around you often breaks, quickly wears off, badly rusts or fails in some other way or cannot do the job in normal use – this is usually due to bad engineering design.

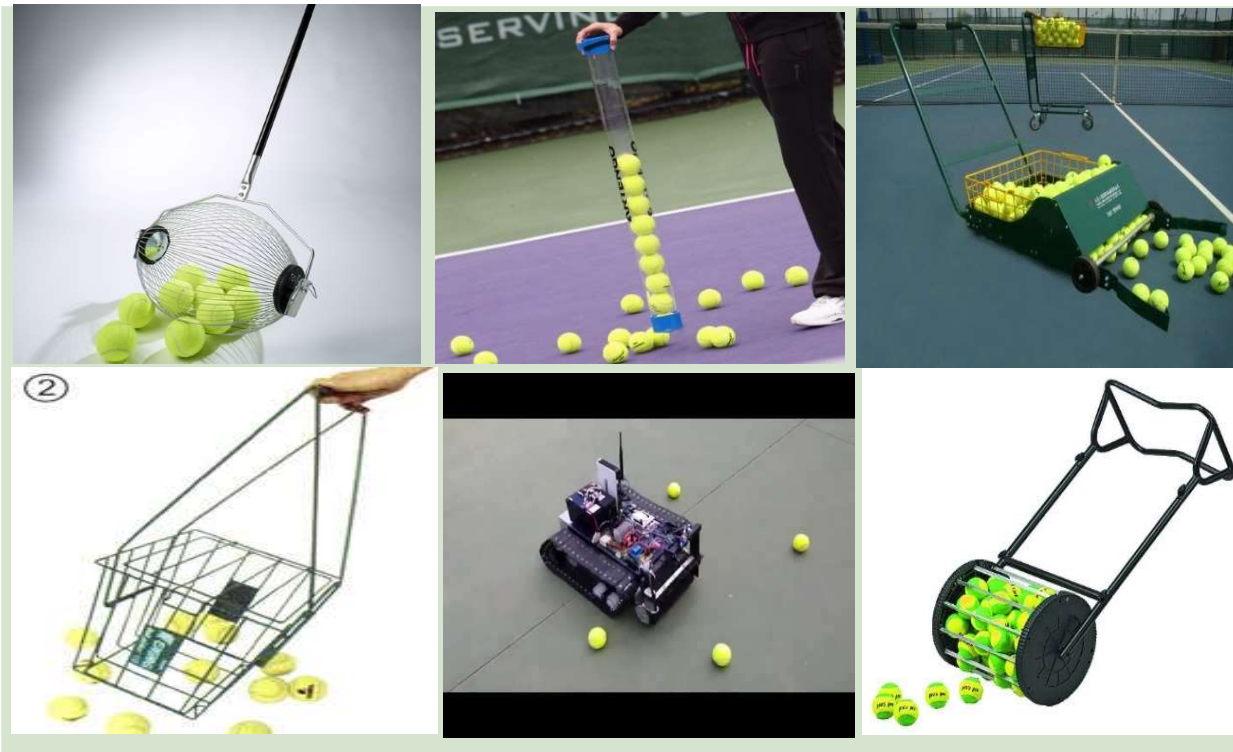


The engineering design process is a series of steps that guides engineering teams as they solve problems. Engineering design process is mostly a teamwork.

Analysis

1


Võimalike variantide valik

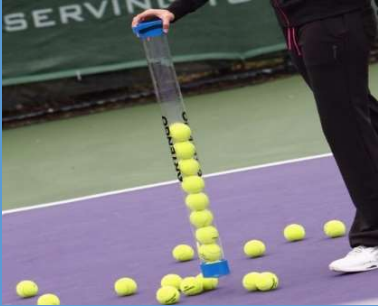


Hindamiskriteeriumid

1. Weight
2. Size
3. Capacity
4. Power
5. Type of the floor

Functionality Analysis and Functional Structure

Variant nr.1		Hinnang parameetri jargi:				Katte			Üldhind	
		kaal	suurus	kogus	jõupi ngut us	vaip	rohi	maa	põrand	
		3	3	1	1	3	3	1	2	17
Märkused										
Требуется частая замена спиц. Большн подходит для мелких предметов										

Variant nr.2		Hinnang parameetri jargi:				Katte			Üldhind	
		kaal	suuru s	kogus	jõupi ngut us	vaip	rohi	maa	põrand	
		3	3	1	1	3	1	1	2	15
Märkused										
Сложно «поймать» мяч в устройство. Может попадать трава или другие мелкие предметы внутрь устройства										

Analysis of the selected product



Kaal – 10 kg

Kogus – 96 palli

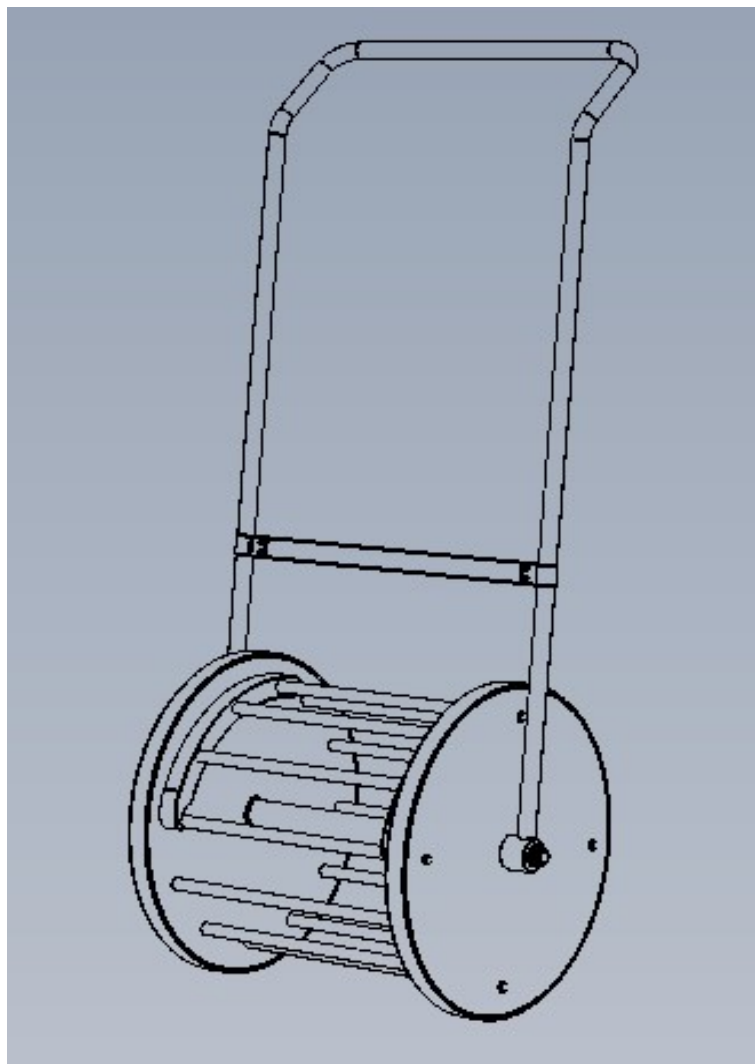
Korvi suurus – 31*37,2 sm

Pikkus – 96 sm

Pakendi suurus 35,6*35*46,5 sm

Hind - \$89.95

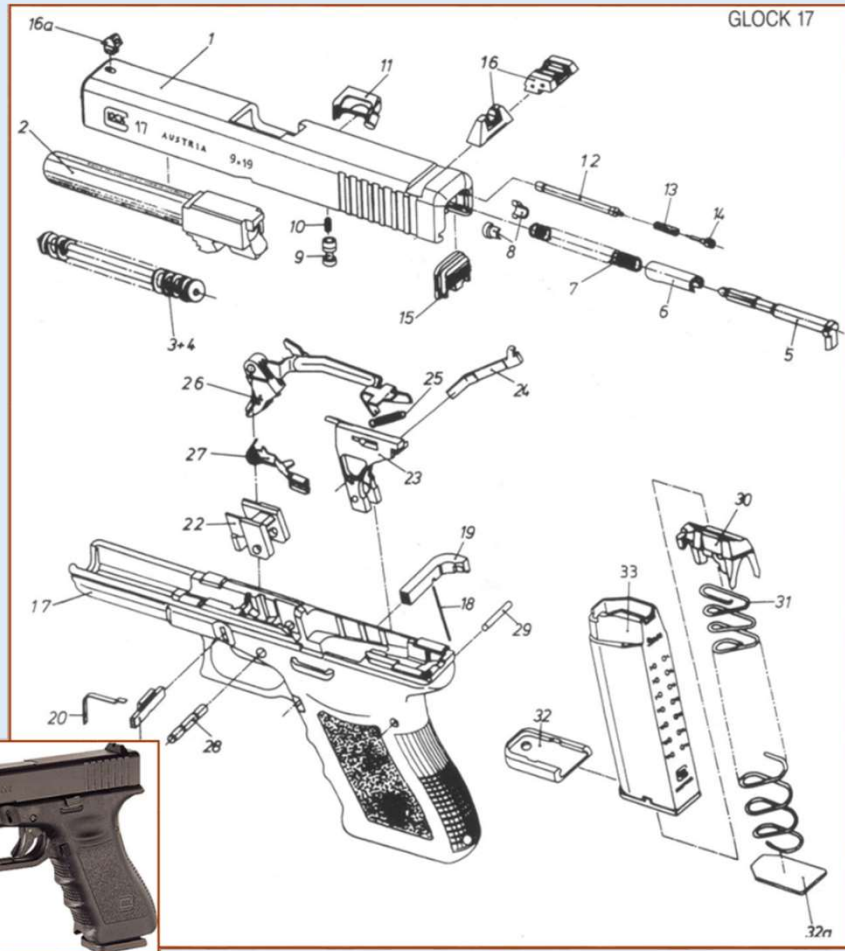
New product design



Arvele võetud:

- Kogus - 72 palli
- Palli läbimõõt 67 mm

Mechanical structure and its components



Conclusion: K I S S



A design engineer' task IS NOT:

to design the world best machine or structure.

A design engineer' task IS:



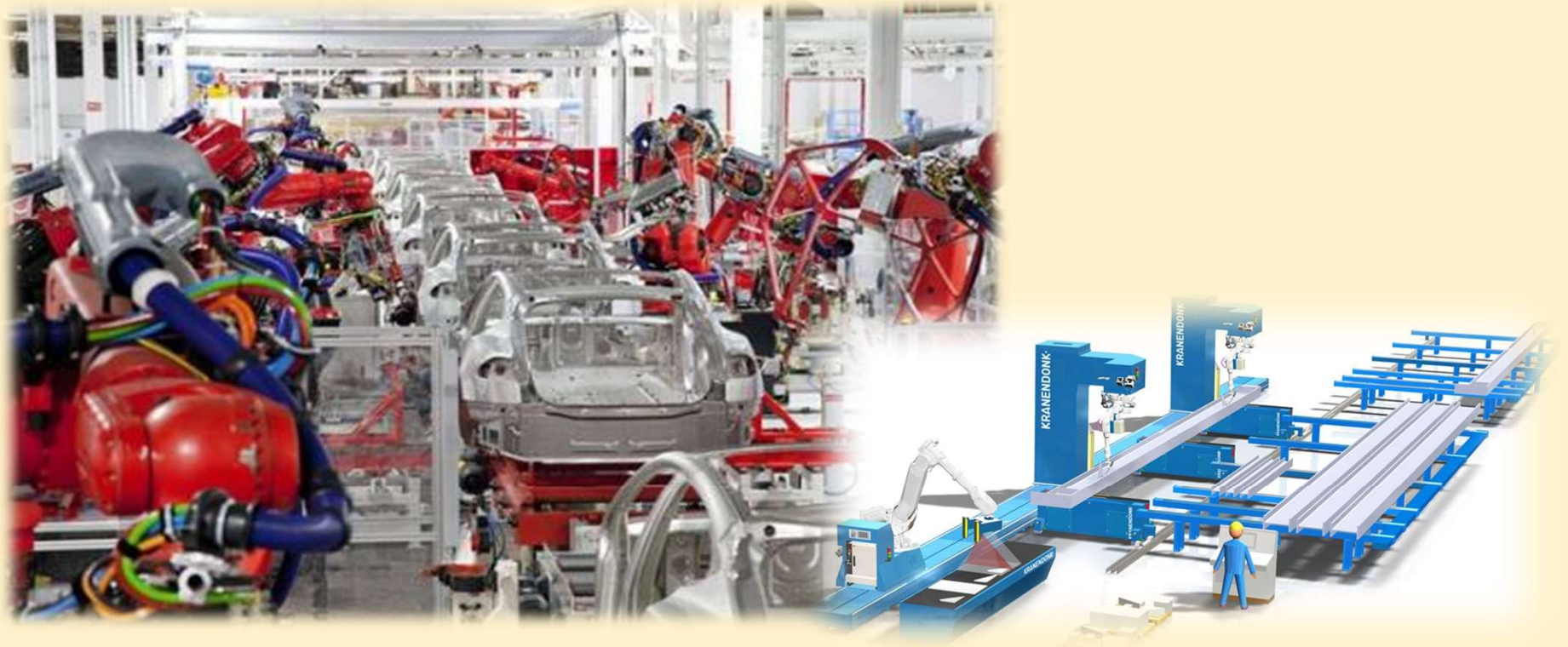
to design the machine or structure according to agreed specification:

- that is safe and reliable.
- that is easy to manufacture, maintain and utilise.
- in required deadlines.
- in given budget.

KISS = *Keep It Simple, Smart* = the best design engineering strategy

Automated Assembling (Automaatne koostamine)

Toivo Tähemaa



Automated assembly process consist of following steps:

1. **Feed the parts** – depending on part size and shape different feed methods are used.
2. **Detect the parts presence in the pickup position** – confirm, that part is in the position.
3. **Check the part** – Confirm, that part is genuine and suitable for assembly.
4. **Orientate the part** – If needed, part is turned around or pick-up system is informed to turn part around after pick-up.
5. **Pick the part** – Grab the part and remove it from the feeder.
6. **Mate the part in its position** – Put part on its position in the assembly.
7. **Fasten the part** – one by one or all details together are fixed to the assembly.
8. **Check the assembly** – Insure that assembly is well-assembled and all parts are putted in correct positions.
9. **Packaging** – if product or sub-assembly is transported to the other location.

Automated assembly examples

Automated assembly is mainly applied for mass production but flexible production lines allow us to assemble also smaller series.

https://www.youtube.com/watch?v=2_R8oYQh4Uo (mobile phone screen protector application)

<https://www.youtube.com/watch?v=GDNAY6qYli4> (Fully automated motor assembly line)

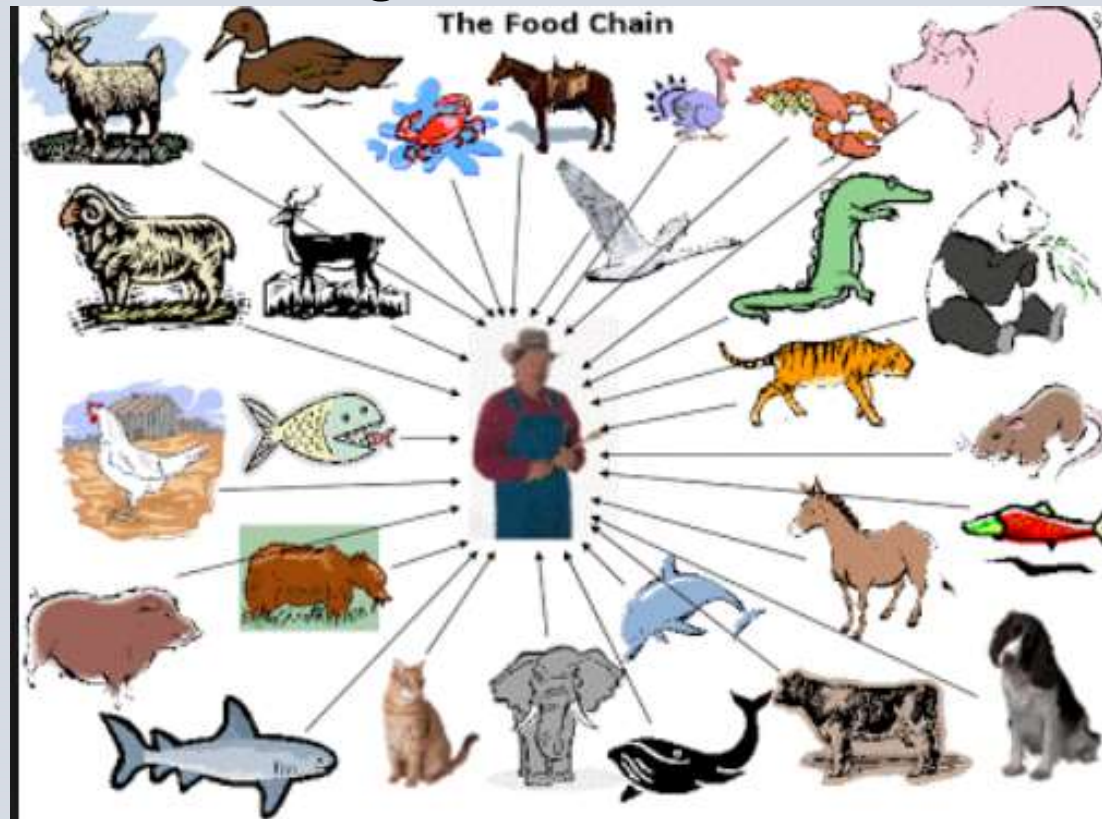
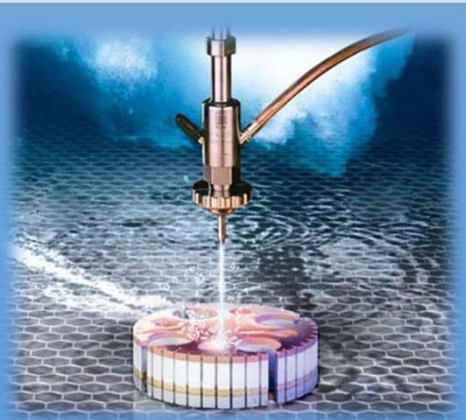
https://www.youtube.com/watch?v=8_lfxPI5ObM (assembling TESLA automobile)

<https://www.youtube.com/watch?v=pGqPjYALB50> (BMW X2 production)

<https://www.youtube.com/watch?v=BepAMlrJwXI> (Pick and place introduction)

Metal Cutting (Metalli lõikamine)

Igor Penkov



Turning (Treimine)



<https://www.youtube.com/watch?v=8EsAxOnzEms>

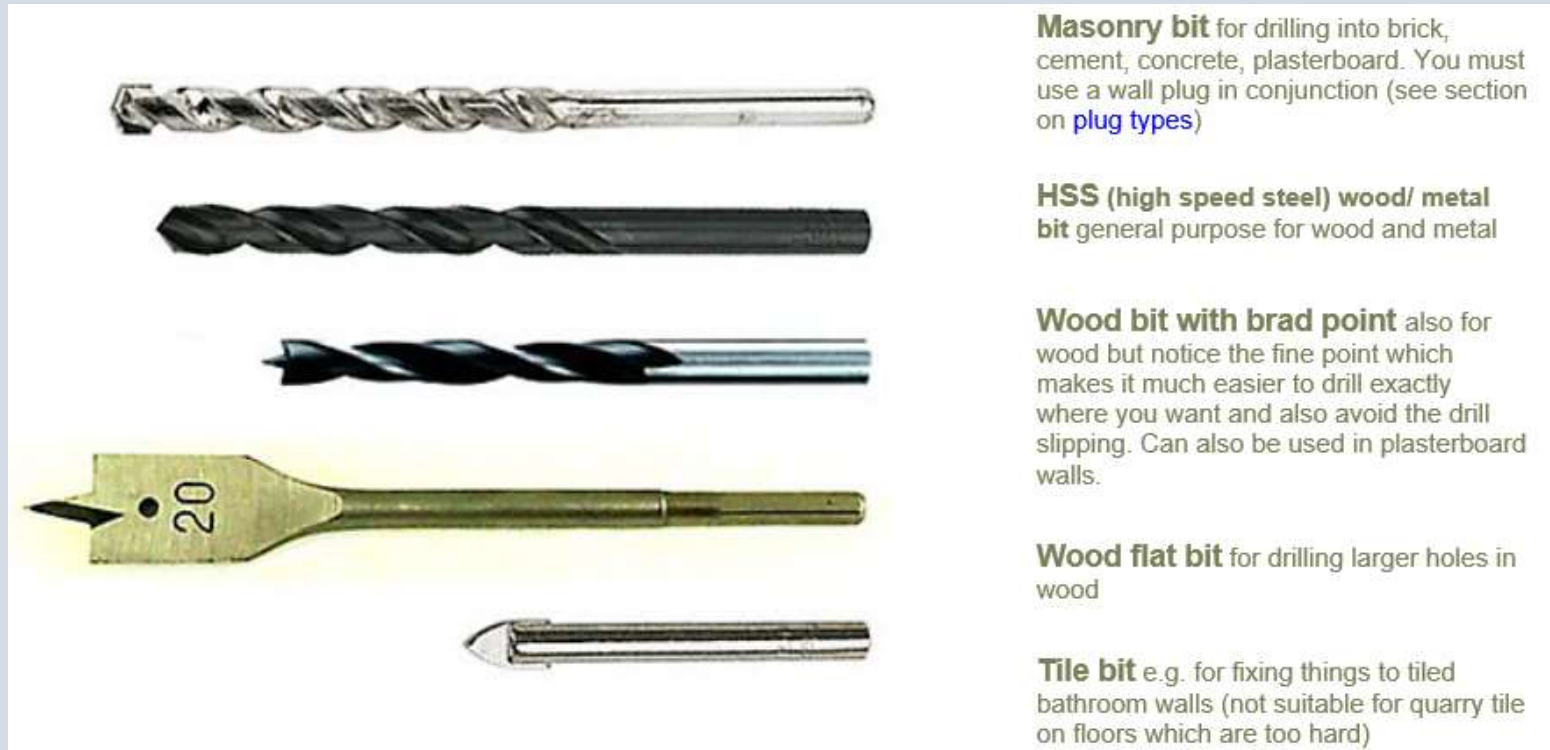
Milling (Treimine)

Milling is a cutting process that uses a milling cutter to remove material from the surface of a workpiece. The milling cutter is a rotary cutting tool, often with multiple cutting points. As opposed to drilling, where the tool is advanced along its rotation axis, the cutter in milling is usually moved perpendicular to its axis.

<https://www.youtube.com/watch?v=Ef59DogwLrI>



Drilling (Puurimine)



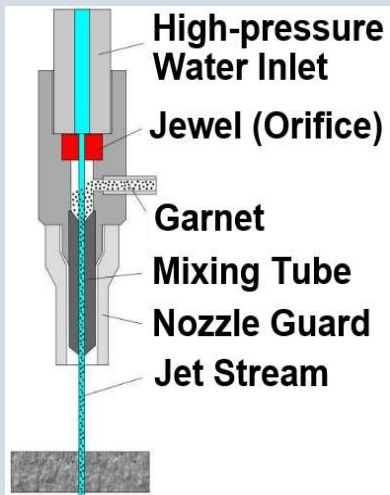
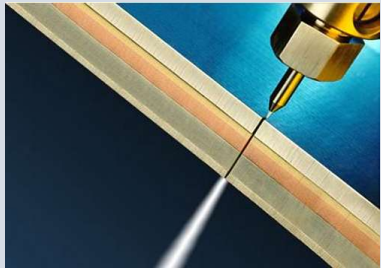
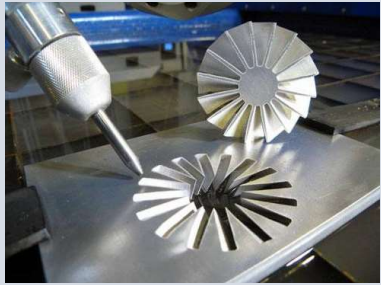
<https://www.youtube.com/watch?v=KYfAjakKO5w>

Laser cutting (laser lõikamine)



https://www.youtube.com/watch?v=PIF_oXvbu4s

Waterjet cutting



<https://www.youtube.com/watch?v=XfGkLsUm92Q>

<https://www.youtube.com/watch?v=IMSGHJ8GJ1A>

Heat Treatment (Termotöötlus)

Riho Tarbe



The term heat treatment is used to describe the controlled heating and cooling of materials for the purpose of altering their structures and properties.

<https://www.youtube.com/watch?v=fLvZkZxiXnE>.

Heat treatment cycle



Hardening influence to the mechanical properties.

1 – soft and ductile part without hardening, easily bendable;

2 – hardened part without tempering, really fragile and breaks already applying minor force;

3 – hardened and high temperature tempered, bendable only by applying bigger force;

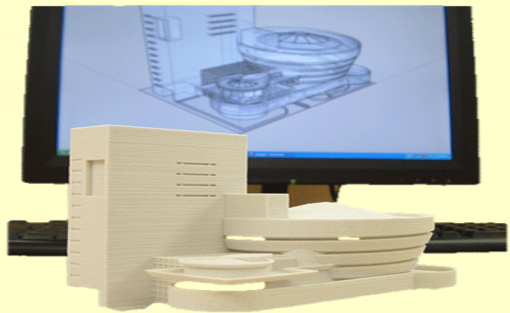
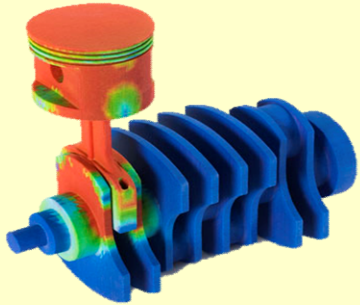
4 – hardened and tempered with optimum tempering, bendable only slightly and when by applying big force

3D Printimine

Additive Manufacturing and Rapid
Prototyping Technology

Kashif Mahmood

What it is!



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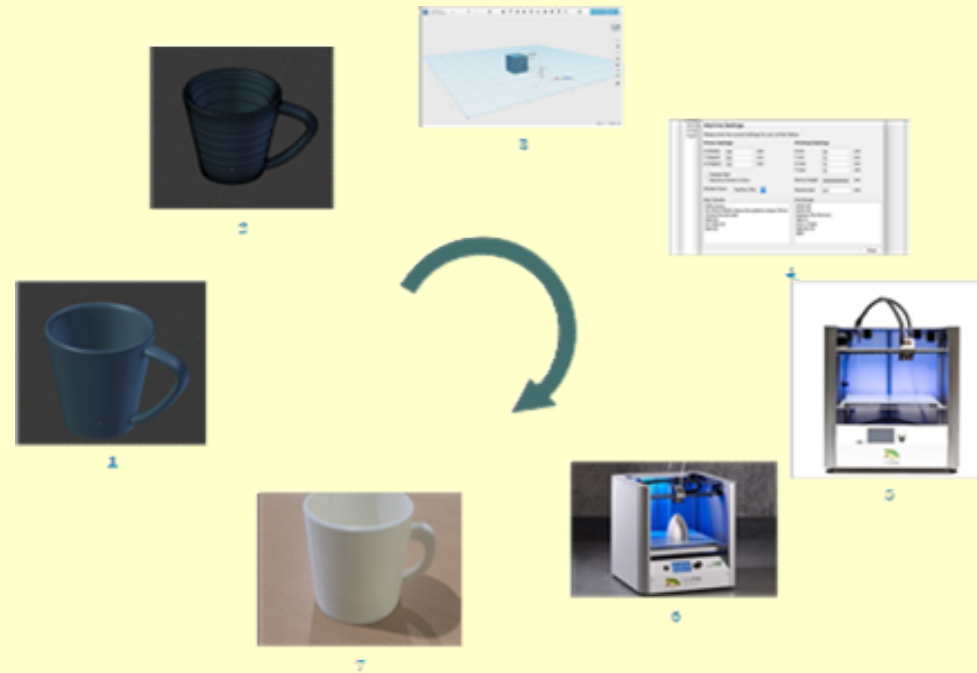
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Where it can be used!

Applications of 3D Printing:

- Prototypes
- Proof of Concept
- Mock-ups (Макеты)
- Educational Opportunities



Injection Moulding and Vacuum Forming (Vaakum vormimine)

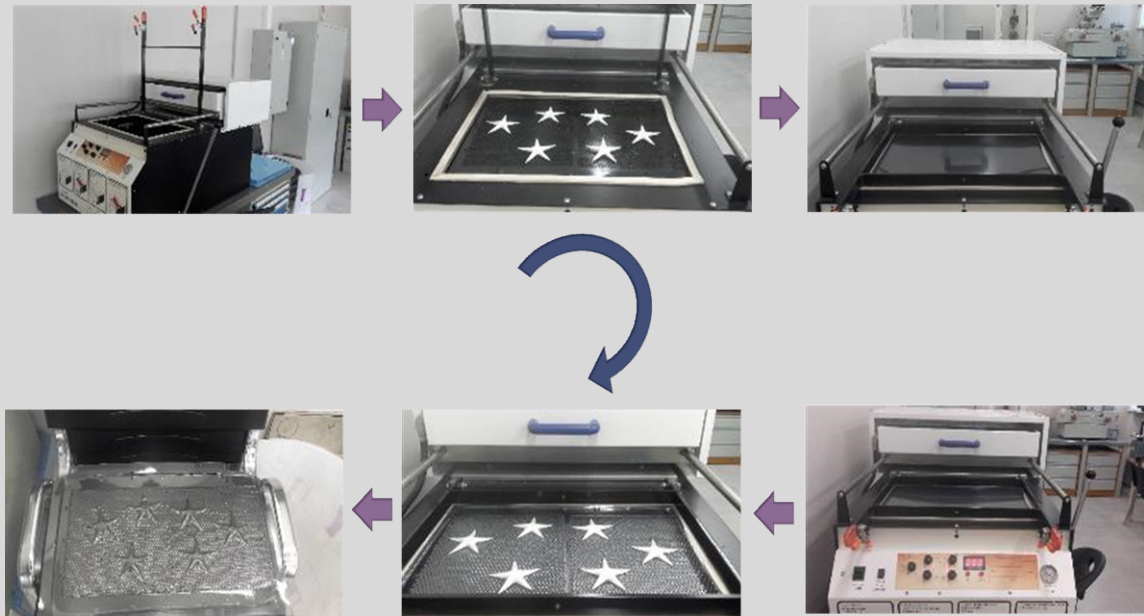
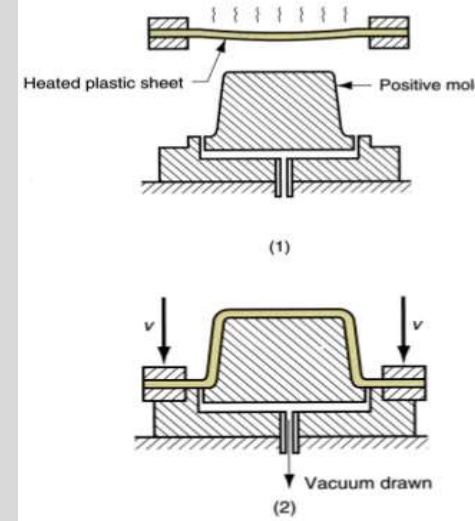
Kashif Mahmood

Manufacturing Processes (Shaping or Moulding Process)

How it can be proceed!

Vacuum forming steps:

- Inserting of mould into the vacuum forming machine.
- Placing and clamping of plastic sheet.
- Heating of plastic sheet through heater.
- Stretching of mould towards semi-melted (soften) plastic sheet via lever.
- Creating of vacuum via vacuum pump to draw the sheet onto the mould and forming the part.
- Release, cooling and removing of the part.



Where it can be used!

- Applications of Injection Moulding and Vacuum Forming
- Mostly in packaging of food



Videos

<https://www.youtube.com/watch?v=yplxWH0tRG3g> (Vacuum Forming Machine Process demo)

<https://www.youtube.com/watch?v=-tAhCtIF3uo> (Vacuum Forming by using the home appliances)

<https://www.youtube.com/watch?v=b1U9W4iNDiQ> (Injection Moulding Process Animation)

<https://www.youtube.com/watch?v=y1Zhpdx-XtA> (LEGO production by injection moulding)

https://www.youtube.com/watch?v=Ens_f2eSXYU (Injection moulding with 3D printed mould)

Virtual Reality (Virtuaalne Reaalsus)

Vladimir Kuts

The concept of Digital Twin (DT) is creating and maintaining a digital representation of the real world of the factory and supporting its management and reconfiguration by the means of optimization and simulation tools, which are fed with real and updated factory data. This concept is not new as it was first used by NASA research in 1957, when the satellite Vanguard was sent into orbit. More than half a century later, recent advances in ICT are offering new opportunities to fully exploit the potential of the DT in the manufacturing field.

Examples of Virtual Reality:

https://unity.com/solutions/film?_ga=2.259433546.1760513859.1534426030-1975044762.1534426030

<https://unity3d.com/unity>

Manufacturing digitalisation (Tootmise digitaliseerimine)

Digitalisation of existing manufacturing equipment and products in 3D CAD software.

Steps:

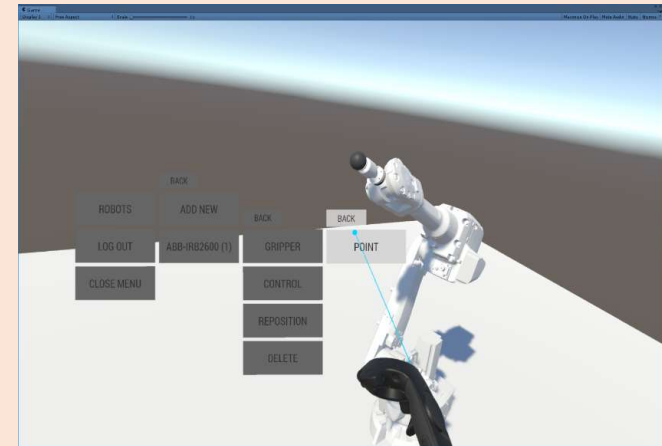
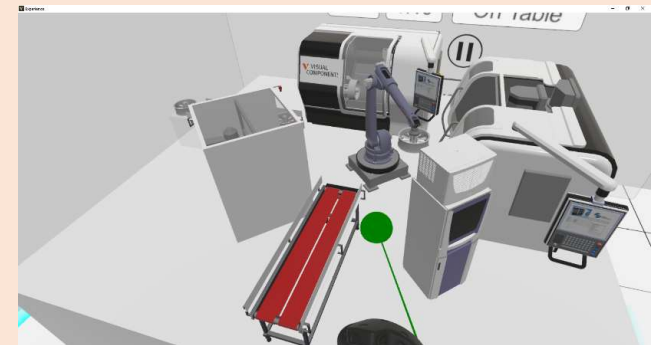
- System architecture creation (draft)
- 3D models preparation
- Interaction enabling - scripting
- Integration

Some videos and tutorials:

<https://youtu.be/f8PRUE0ERO8>

<https://unity3d.com/learn/tutorials/s/interactive-tutorials>

<https://unity3d.com/learn/tutorials/s/roll-ball-tutorial>



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Reede, 05. oktoober 2018

Seminar on eelregistreerimisele tasuta.
Palun registreerige siin

<https://doodle.com/poll/pnwk7q38kacfiii5>

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