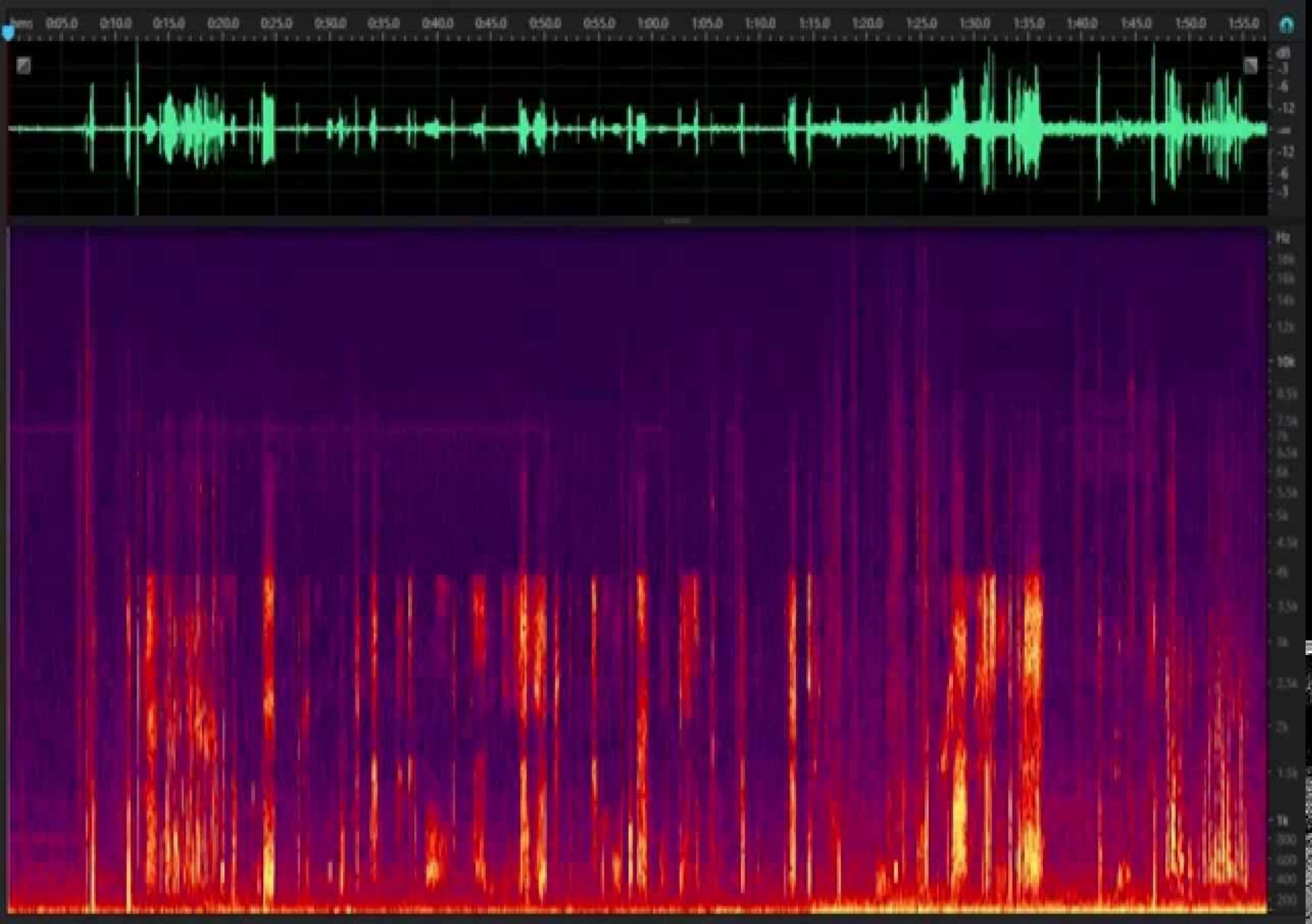
ECE3400 Intelligent Physical Systems


https://www.emcstandards.co.uk/emi-stories


Roy-Rom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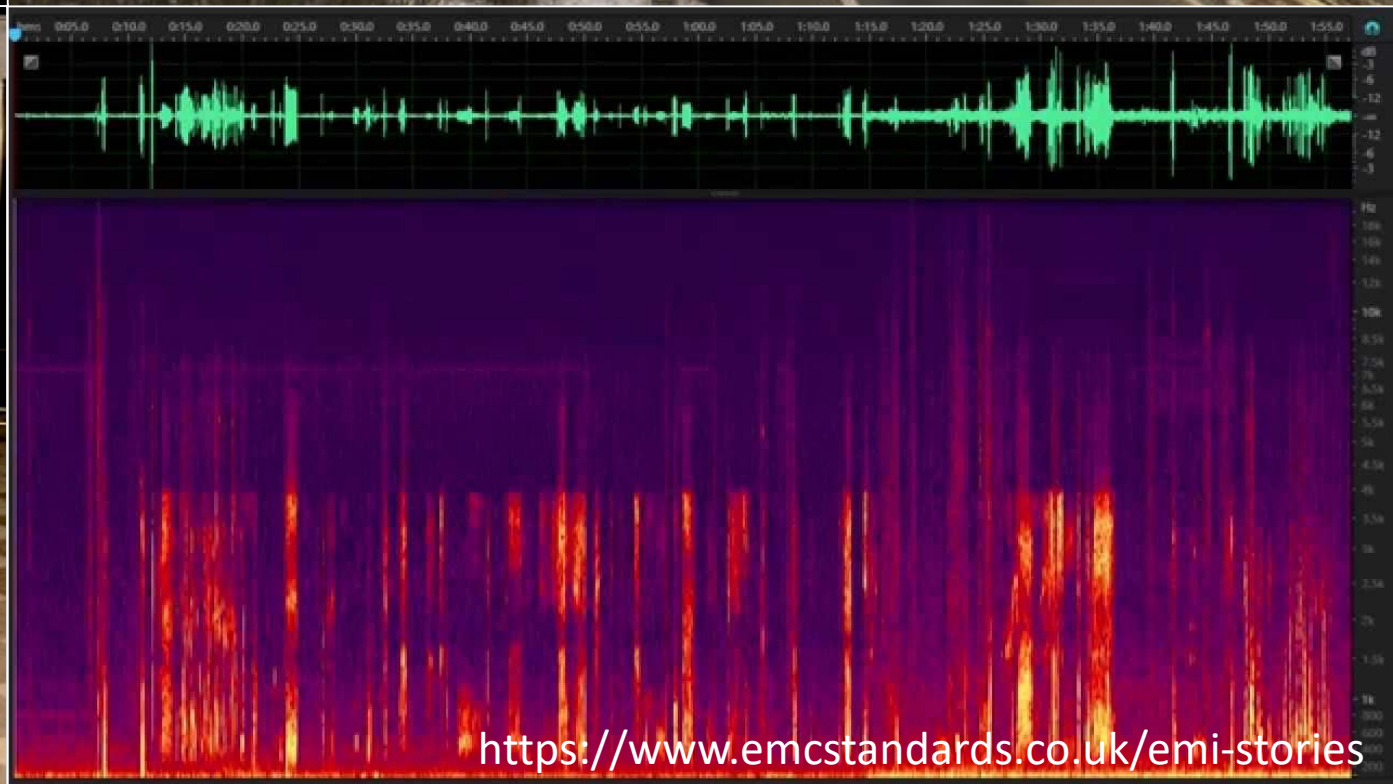
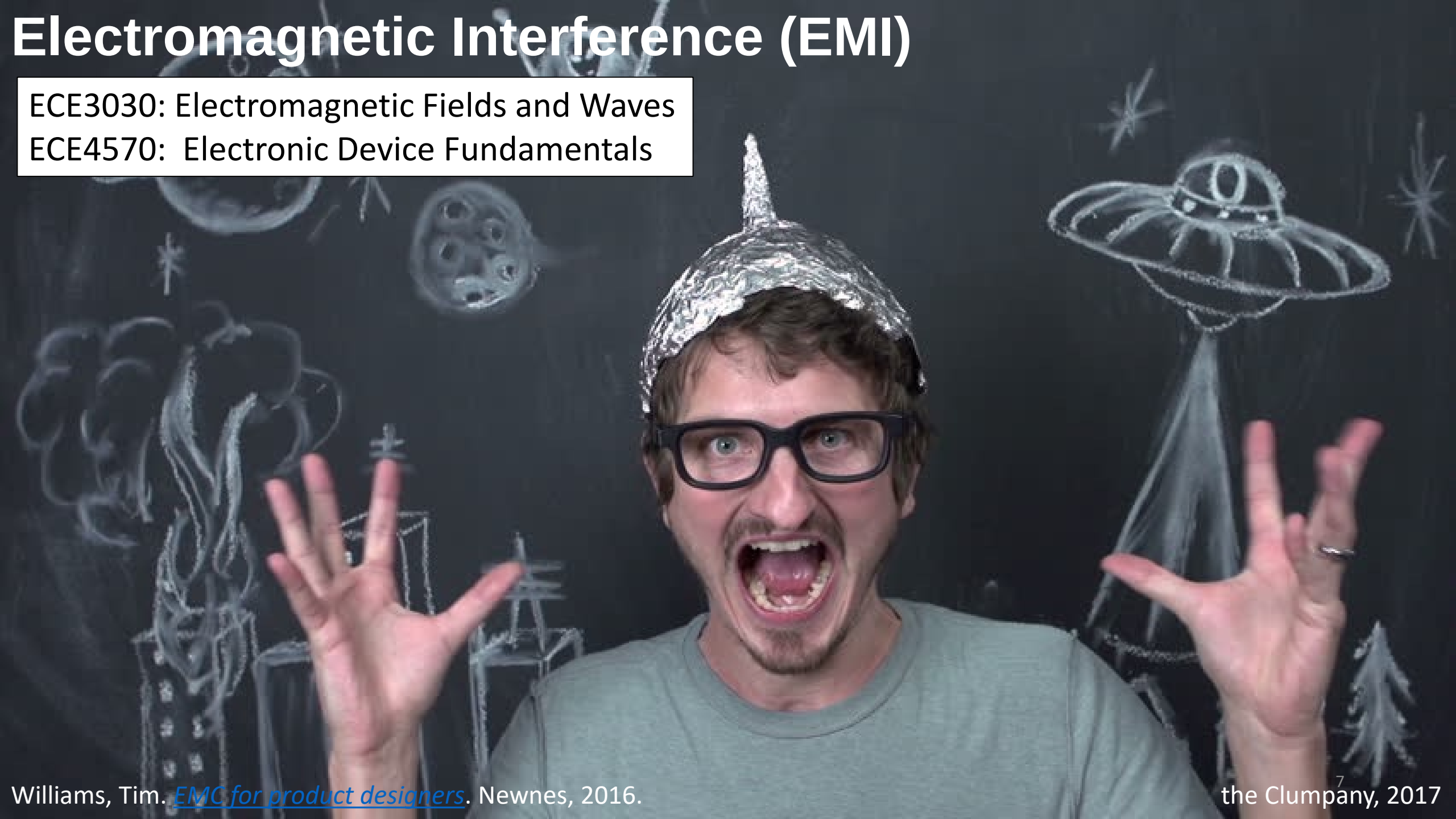
TELEPHONE


Ray-Ban


https://www.emcstandards.co.uk/emi-stories

Electromagnetic Interference (EMI)

ECE3030: Electromagnetic Fields and Waves
ECE4570: Electronic Device Fundamentals



Williams, Tim. *EMC for product designers*. Newnes, 2016.

the Clumpany, 2017


02 . 01
AFP

EMC Directive

- The ability of the system to operate without interfering with other systems
- The ability of the system to operate despite interference from other systems
- Under *typical* conditions (domestic, commercial, industrial)

CE

RAISE Technology Co., Limited Certificate of Conformity

VERIFICATION OF EMC COMPLIANCE

Verification No.	:	RK12E06032
Applicant	:	ZHONGSHAN KINGRONG ELECTRONICS CO.,LTD
Address	:	32, Cuihuju, YangguangMeijia, No.138 MinAn Rd South, Xiaolan, ZhongShan, Guangdong 528415 China
Manufacturer	:	ZHONGSHAN KINGRONG ELECTRONICS CO.,LTD
Address	:	32, Cuihuju, YangguangMeijia, No.138 MinAn Rd South, Xiaolan, ZhongShan, Guangdong 528415 China
Product Name	:	Switching power supply(AC/DC adaptor)
Model Number	:	KRE-XXXYYYZ "xxx"=030-480, the output voltage is: DC3.0-48.0V; "yyy"=001-450, the output current is: 0.01-4.5A; "Z" representing the input plug, 0-European plug, 1-BS plug, 2-Australian plug; 3-USA plug, 4-Japan plug, 5-China plug, 6-Korea plug, 7-South Africa plug, 8-Brazil plug, 9-Argentina plug
Trade Mark	:	KRECO, BILLY
Rating:	:	Input: AC100~240V ,50/60Hz, 1.0A max
Test Standards	:	EN 55022:2010+AC:2011 EN 61000-3-2:2006+A1:2009+A2:2009 EN 61000-3-3:2013 EN 55024:2010

As shown in the
Test Report Number(s): RK12E06032-00

This verification of EMC Compliance has been granted to the applicant based on the results of the tests, performed by laboratory of Shenzhen Raise Technology Co., Ltd. on the sample of the above-mentioned product in accordance with the provisions of the relevant specific standards and Directive 2014/30/EU. The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives.

CE

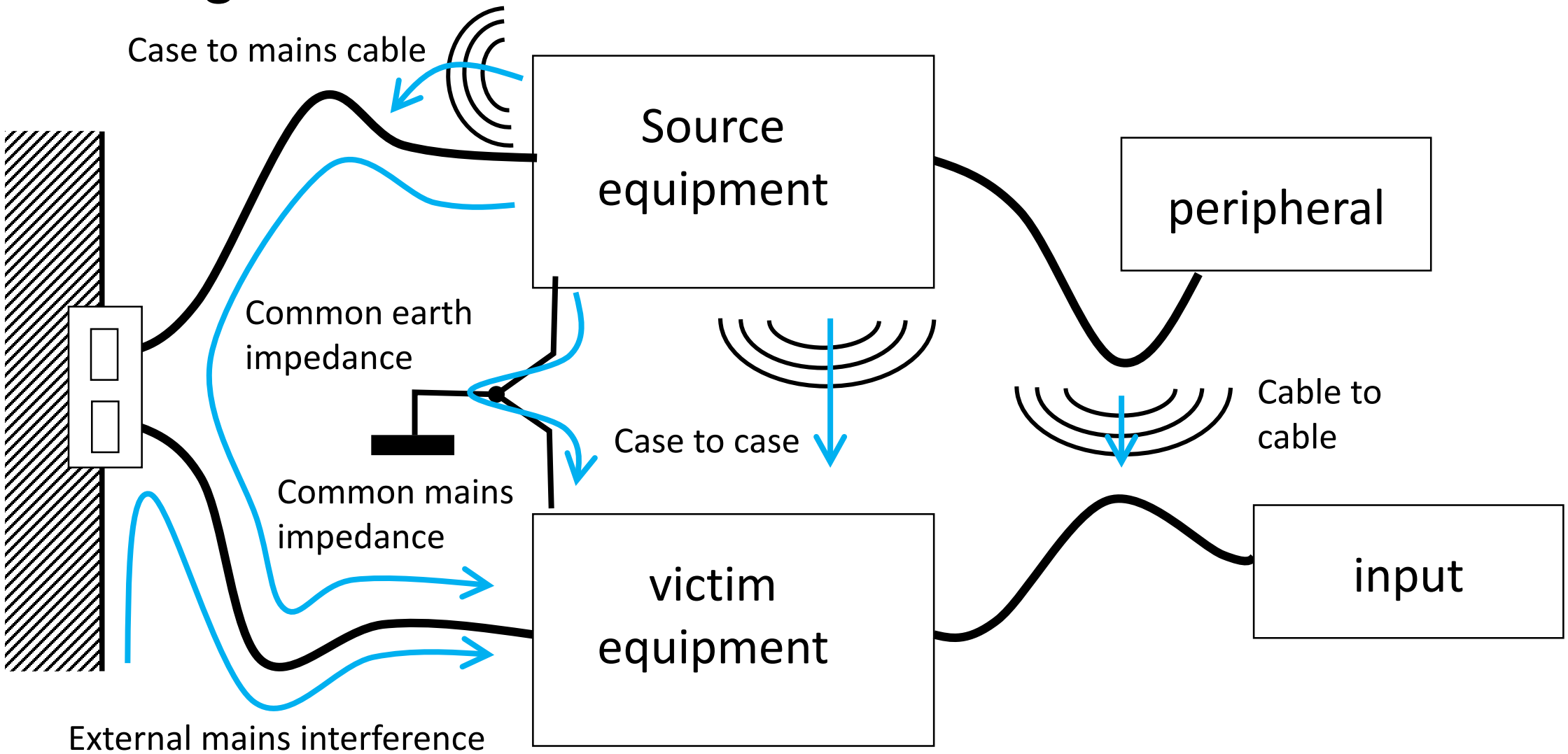
Attestation By: Klan Liu (Manager)

Issued date: May 20, 2016

SHENZHEN RAISE TECHNOLOGY CO.,LTD EMC

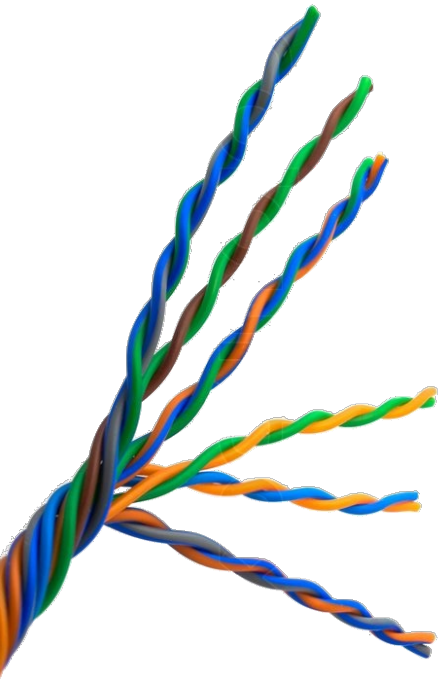
Shenzhen Raise Technology Co., Ltd
Address: Room 1208, West Building, Nanshan Digital Culture Industry Base,Nanshan District, Shenzhen, China
Tel:+86-755-26445590 Fax:+86-755-86052680
Http://www.raise-sz.com E-mail:info@raise-sz.com

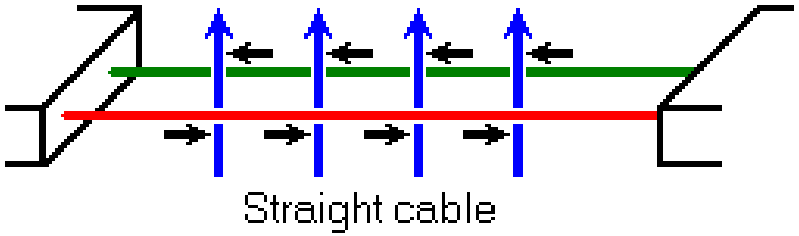
Electromagnetic Interference

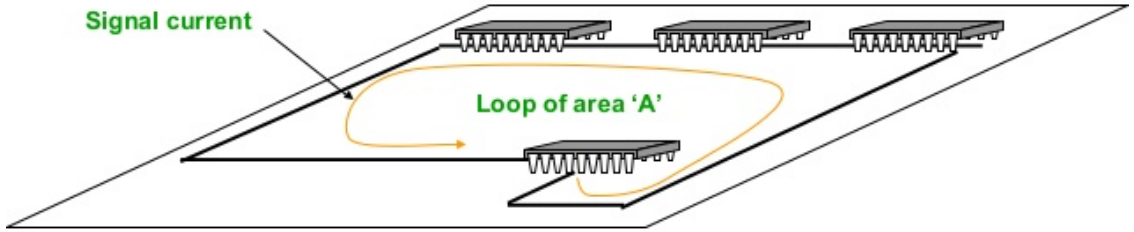


Electromagnetic Interference

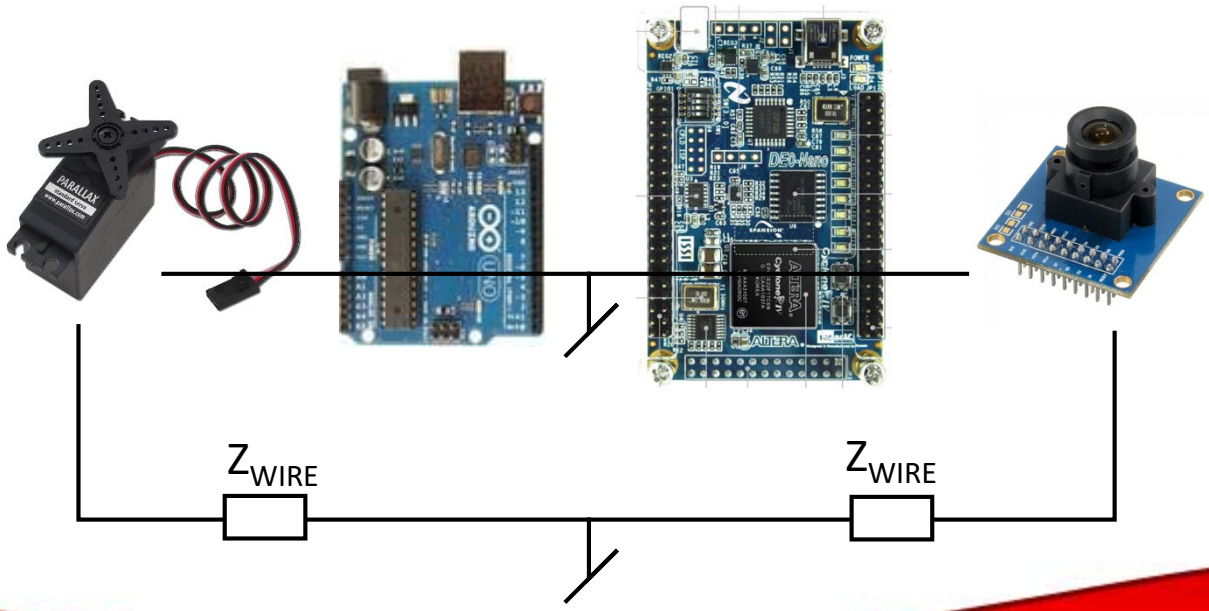
- Keep the area of signal-return loops as small as possible!
- Minimize common impedances



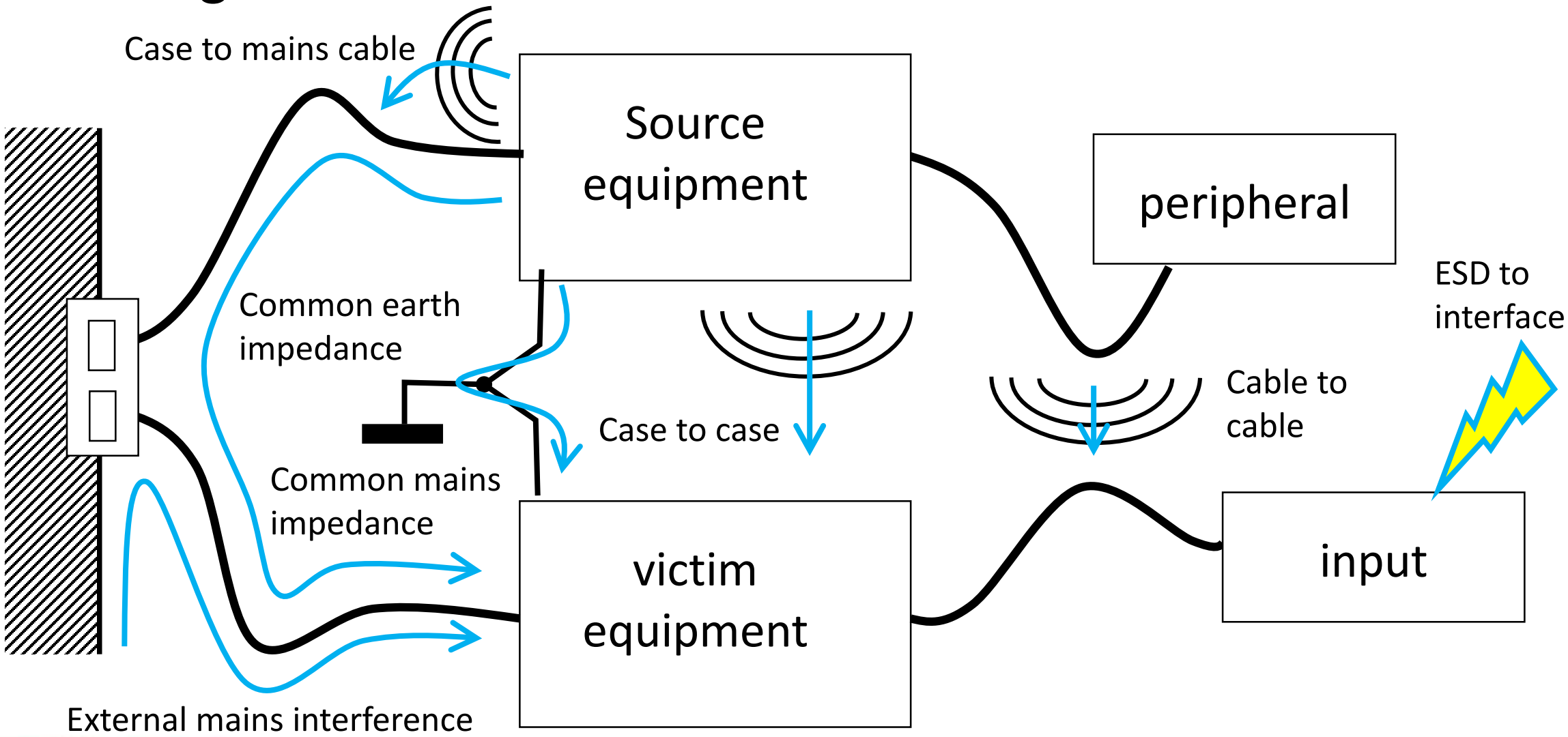




Magnetic field
Induced noise current

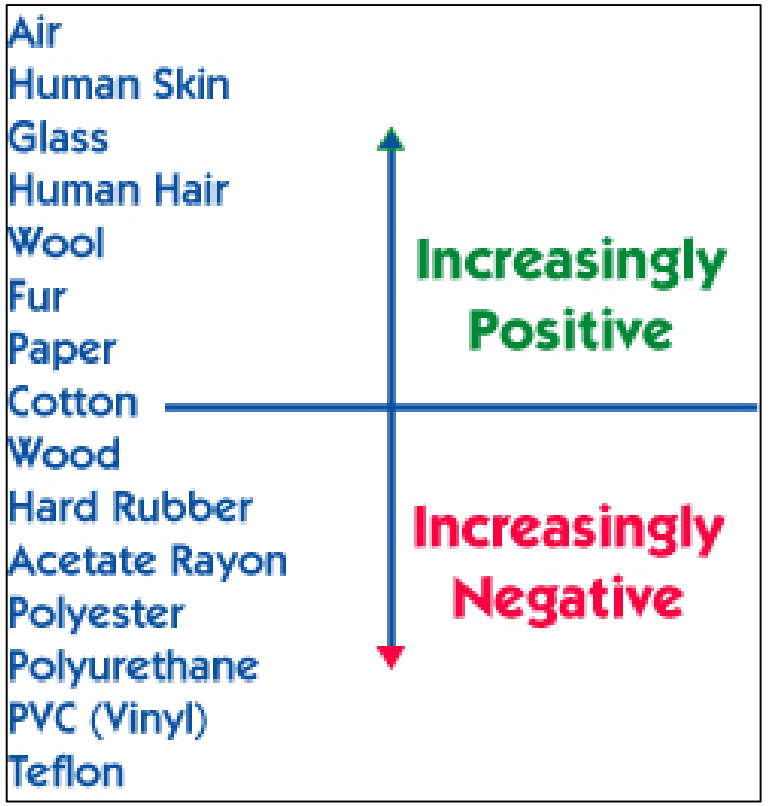


Electromagnetic Interference



Electrostatic Discharge

Static Voltage Generation at different Relative Humidity (RH) levels		
Generation Method	10-25% RH	60-90% RH
Walking across a carpet	35,000Volts	1,500Volts
Walking across vinyl tiles	12,000Volts	250Volts
Worker at a workbench	6,000Volts	100Volts
Poly bag picked up from workbench	20,000Volts	1,200Volts
Sitting on chair with urethane foam	18,000Volts	1,500Volts



What can you do?

- *Always discharge through ground!*


WINTER
IS
COMING
GAME OF THRONES
HDHDWALLPAPERS.COM

Prototyping

www.livingoxymoronart.com

Next week:

- Michael Solomentsev will give a lecture on *laser cutting and 3D printing*

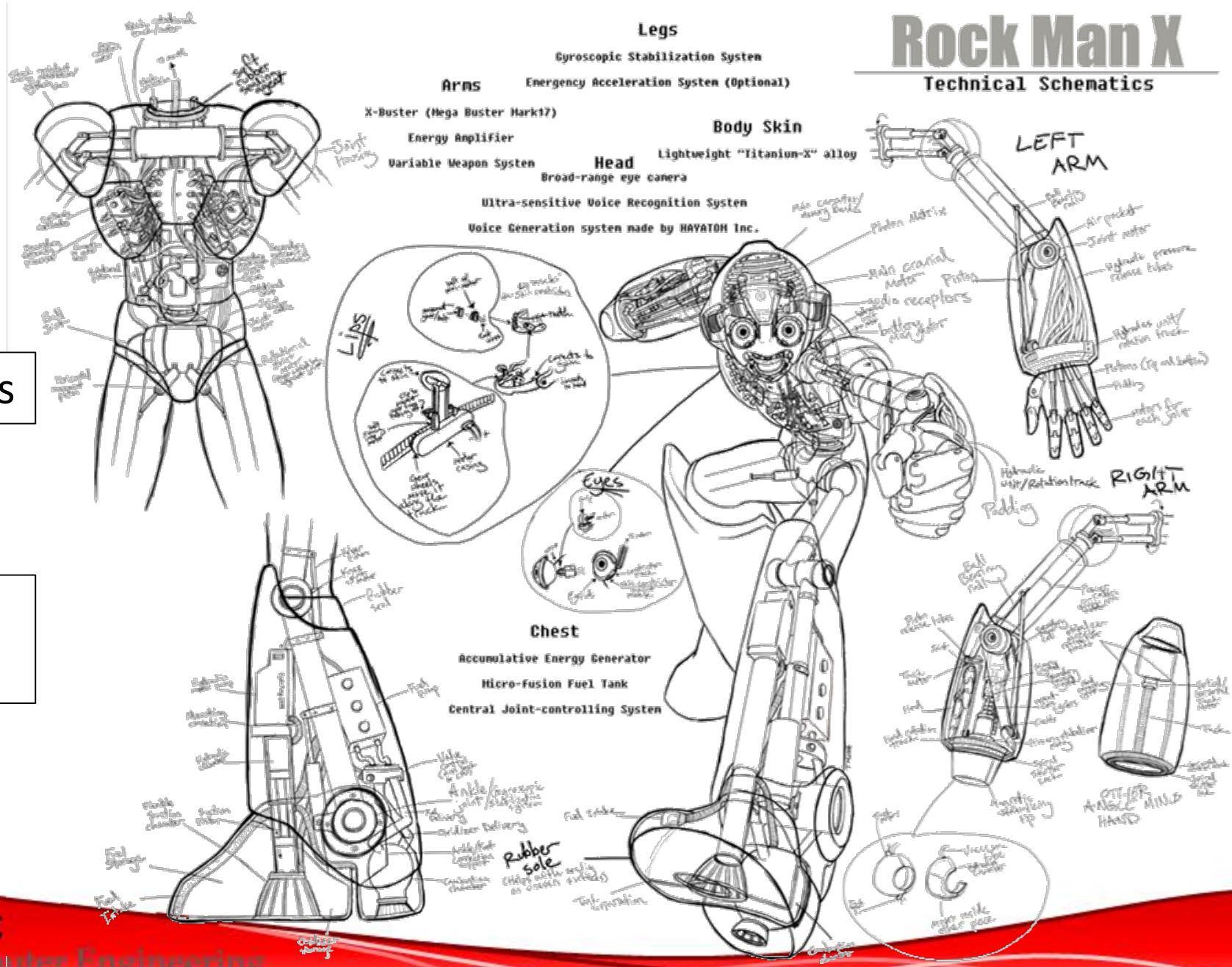
MAE 2250: Mechanical Synthesis

- Logan Horowitz will give a lecture on *PCB design*

ECE 4350: Analog Integrated Circuit Design

Today's topics:

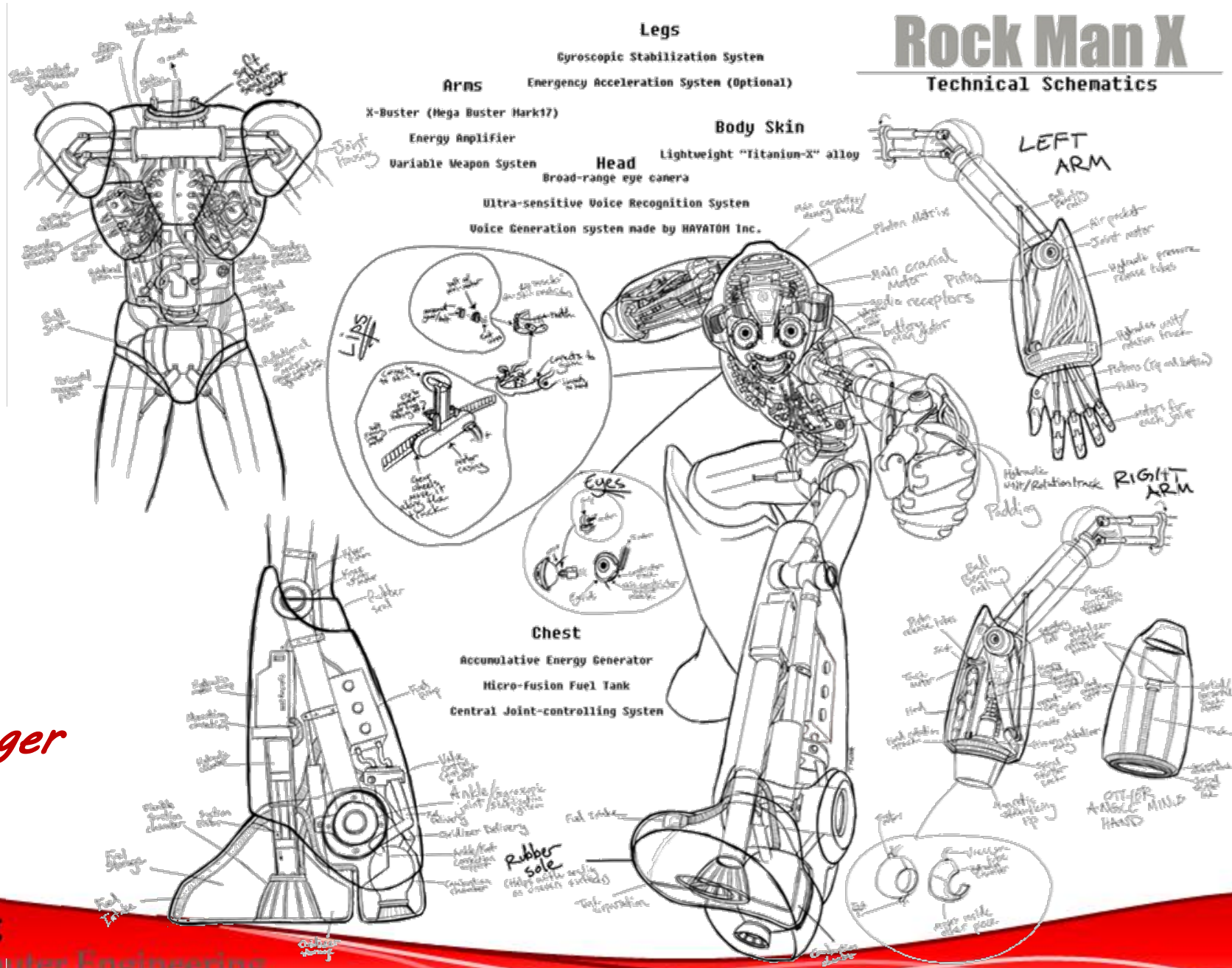
- Mechanical sketching
- Fabrication methods
- Fastening methods



www.livingoxymoronart.com

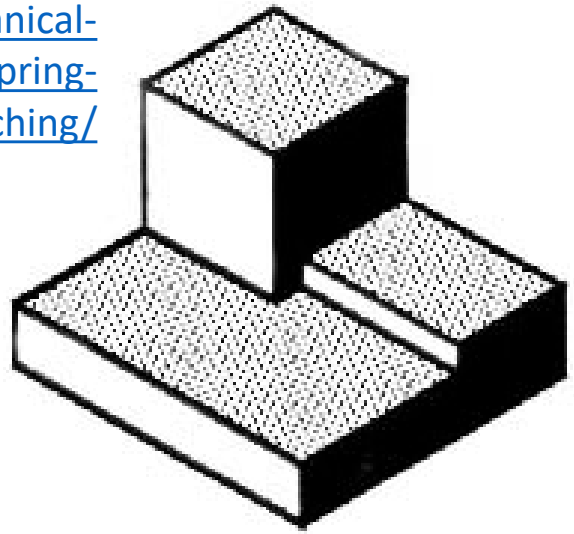
Prototyping

- Ideas are cheap
- Feasibility tests
- Decide what specifically to prove/demonstrate
- Put in *just enough* work
- Cool demonstration
- Always start with a sketch
- The 3T's
  - Things Take Time
  - *Making things take longer*

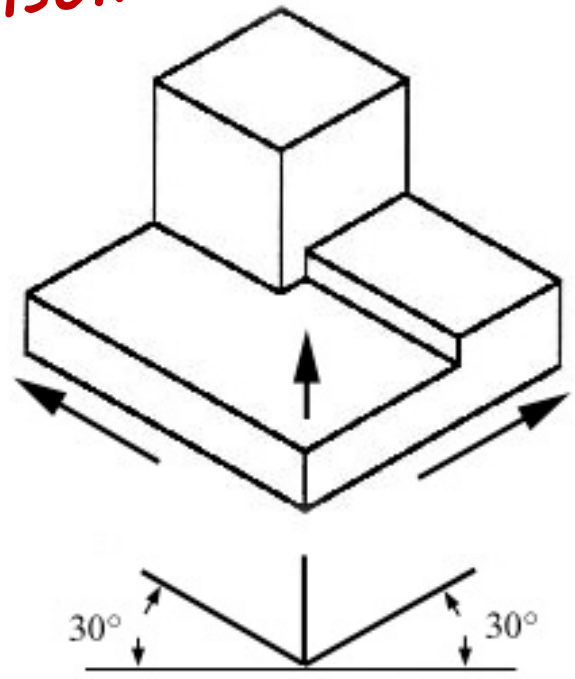


Sketching: Views

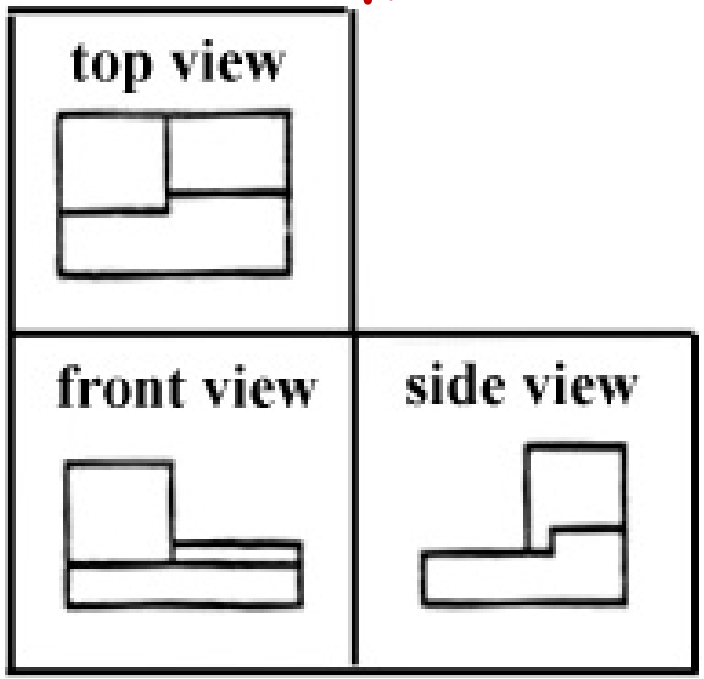
https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/

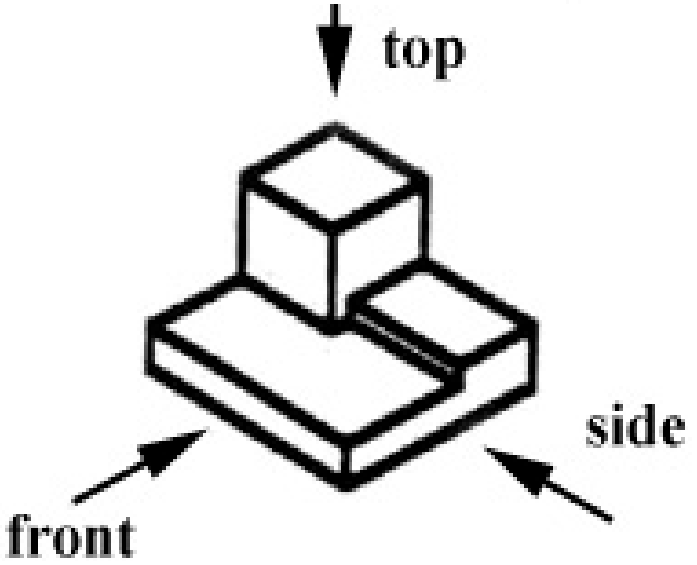


Isometric drawing

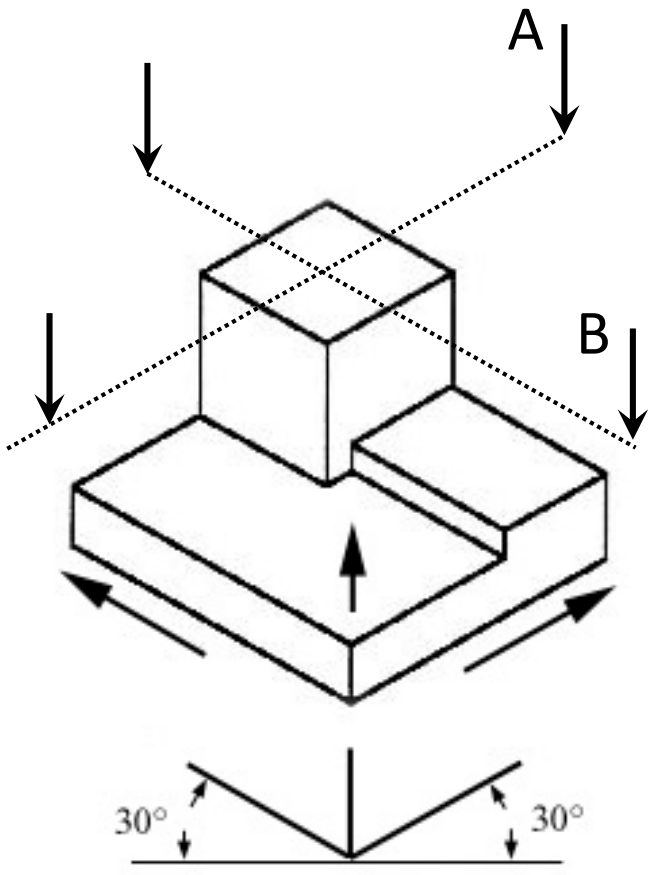


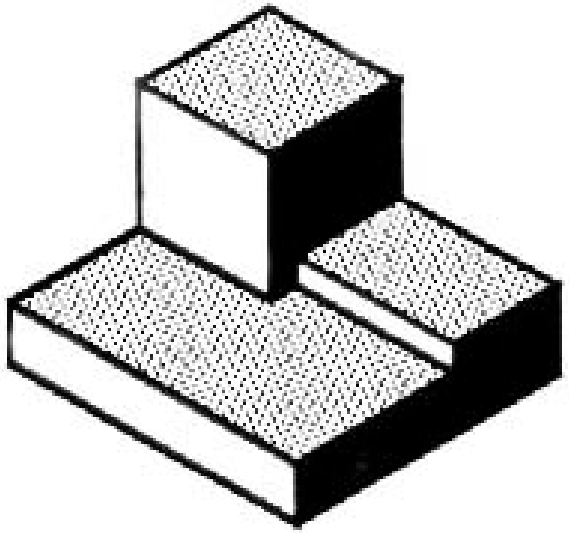
Multi-view drawing



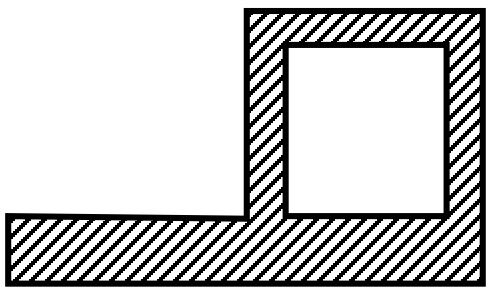


Sketching: Sections

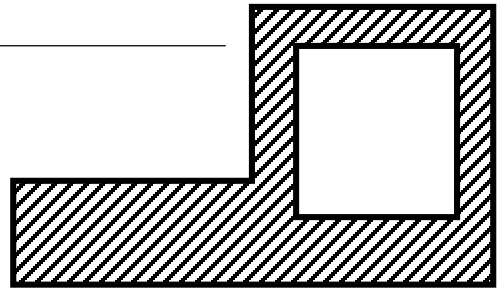




Section A:

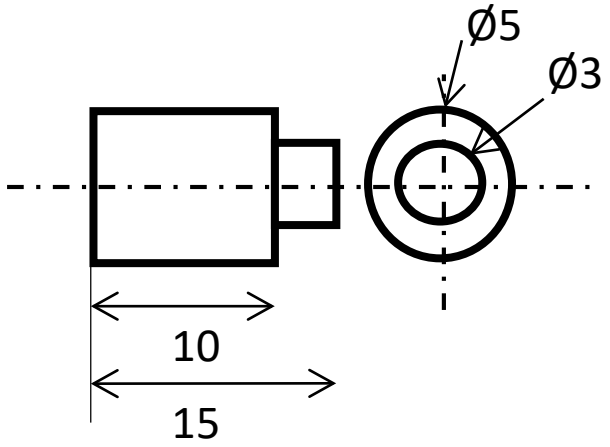


Section B:

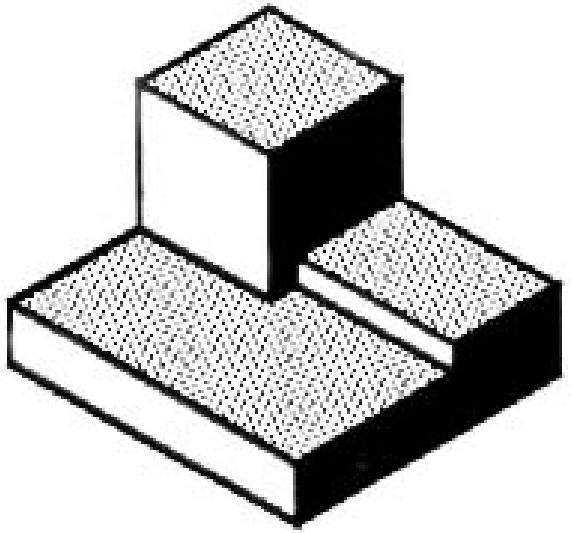


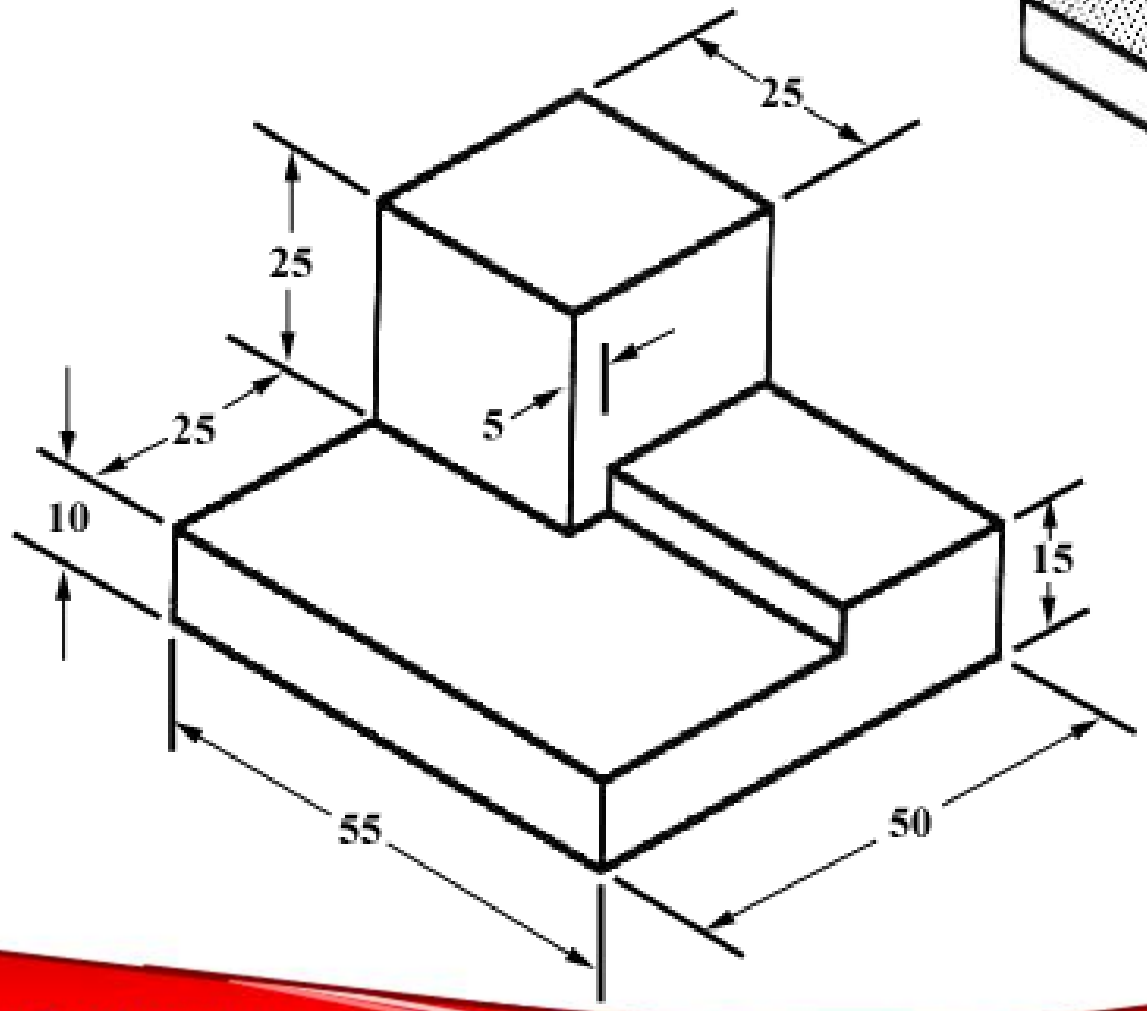
Sketching: Dimensioning

- Mark the units
- Dimensions are marked between relevant points
- Avoid redundant measures
- Stippled lines mark symmetry
- Tolerances determine the manufacturing process



How will this piece fit into the next?

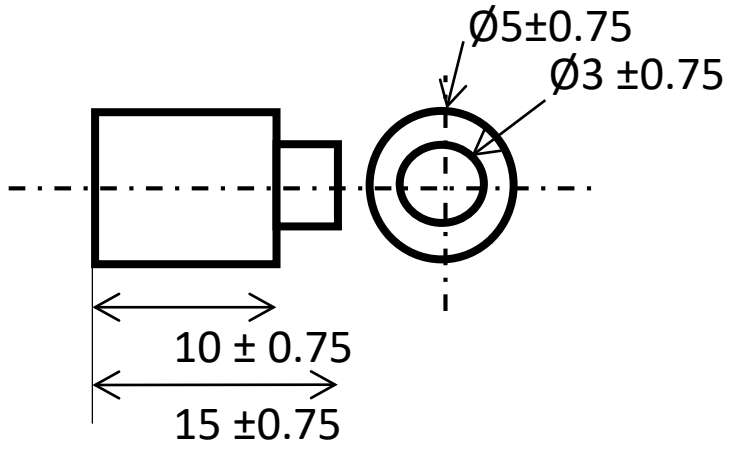


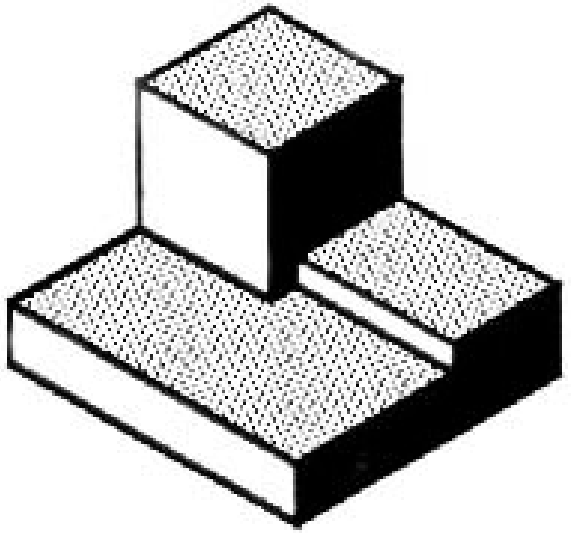


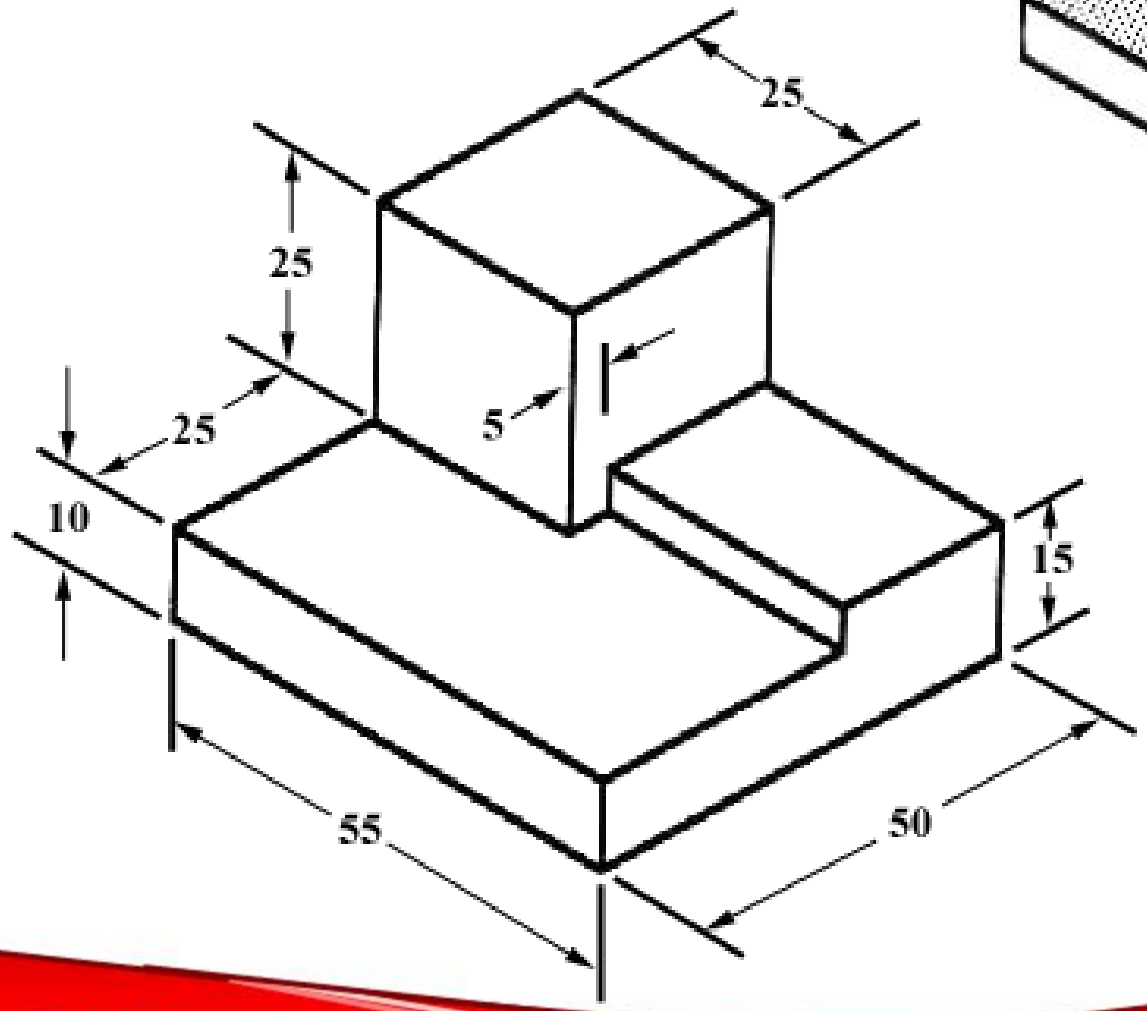
units: [mm]

Sketching: Tolerances

- Mark the units
- Dimensions are marked between relevant points
- Avoid redundant measures
- Stippled lines mark symmetry
- Tolerances determine the manufacturing process



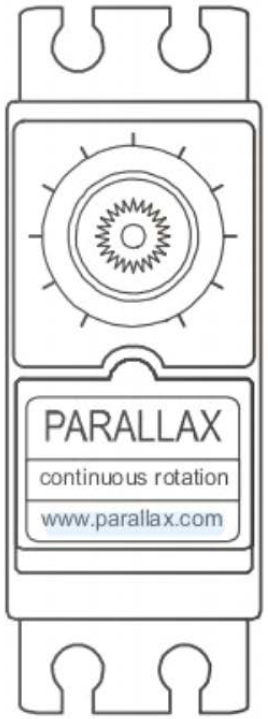


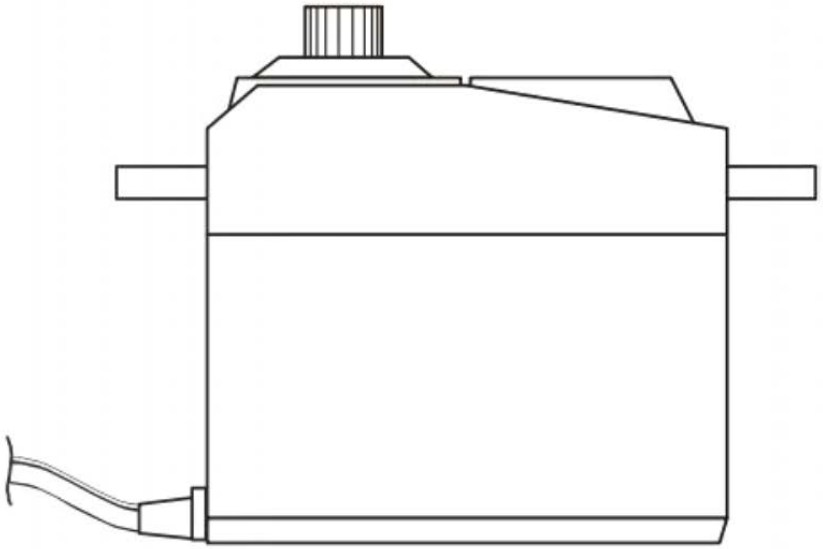


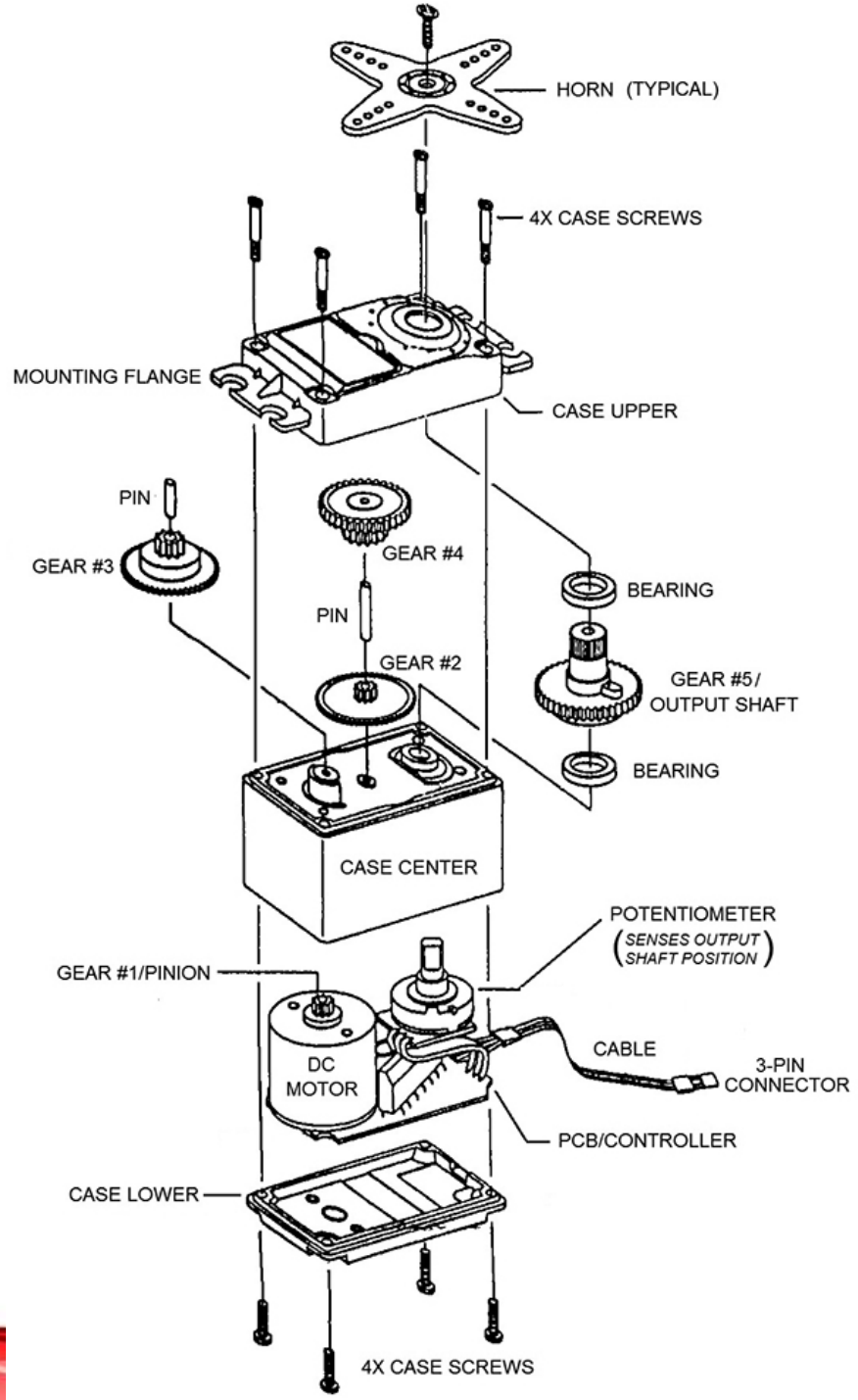
units: [mm]

Sketching: Assemblies

- Holistic idea of the mechanism
- Exploded view

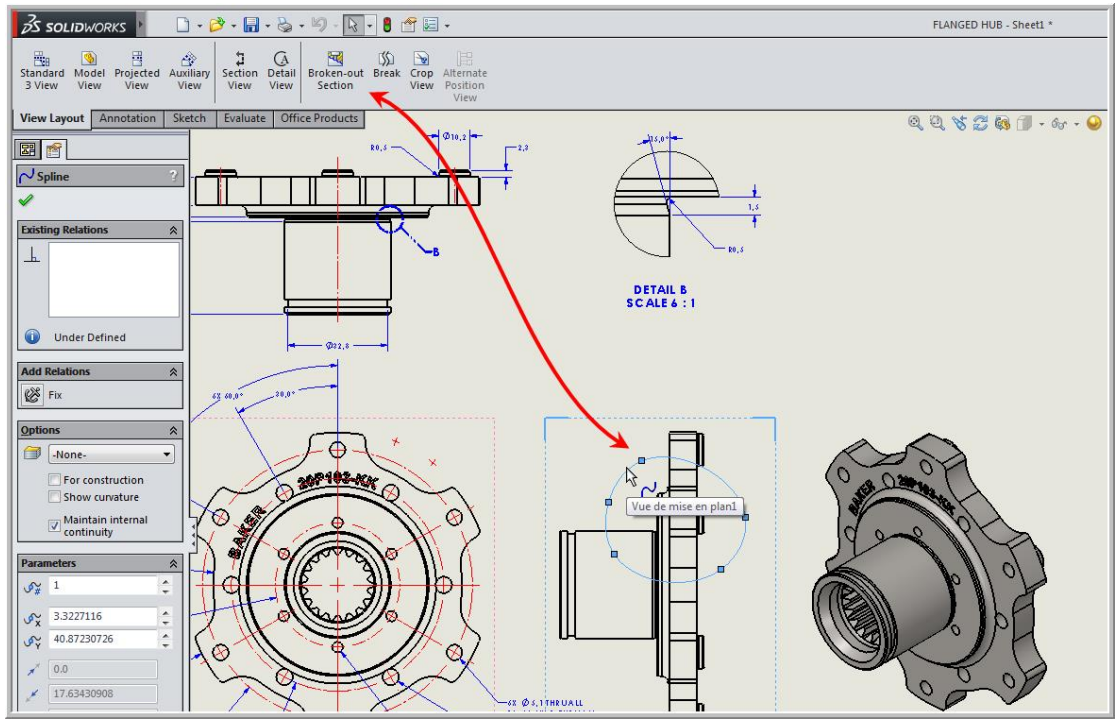




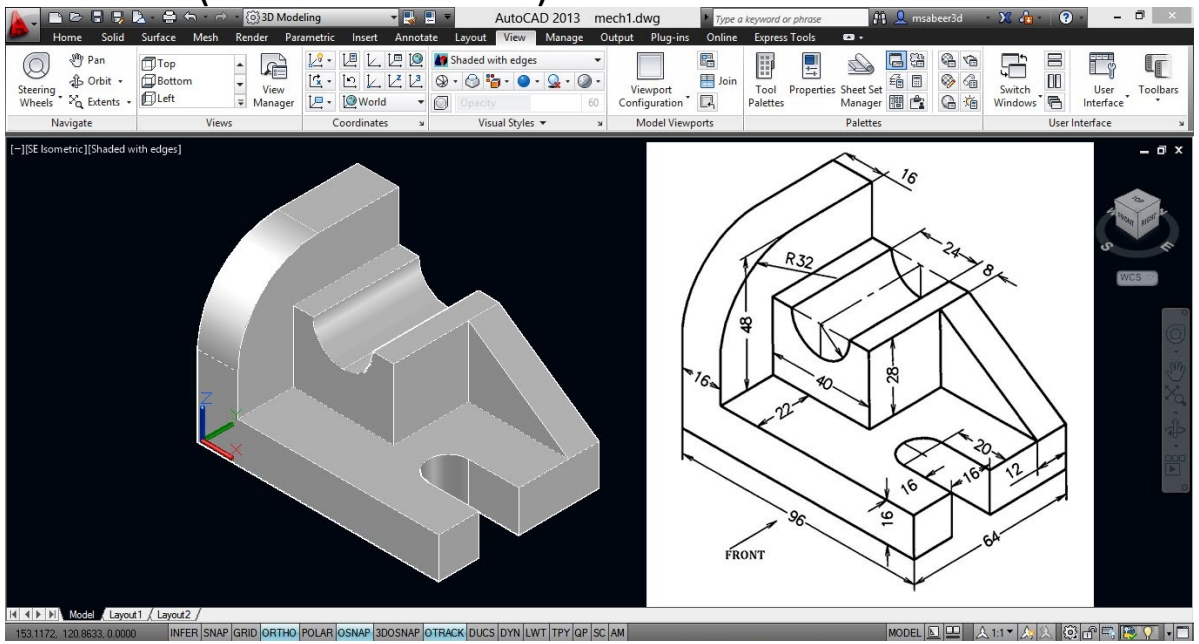


CAD Software

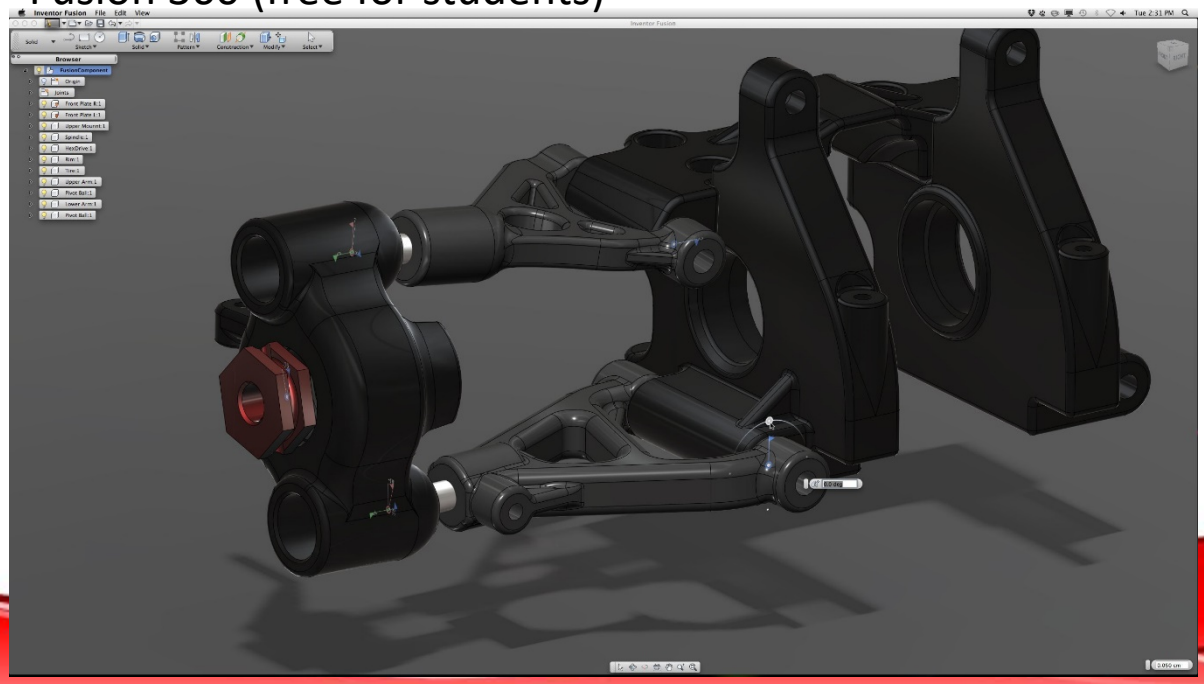
SOLIDworks (available in Upson and Phillips)



AutoCAD (free for students)

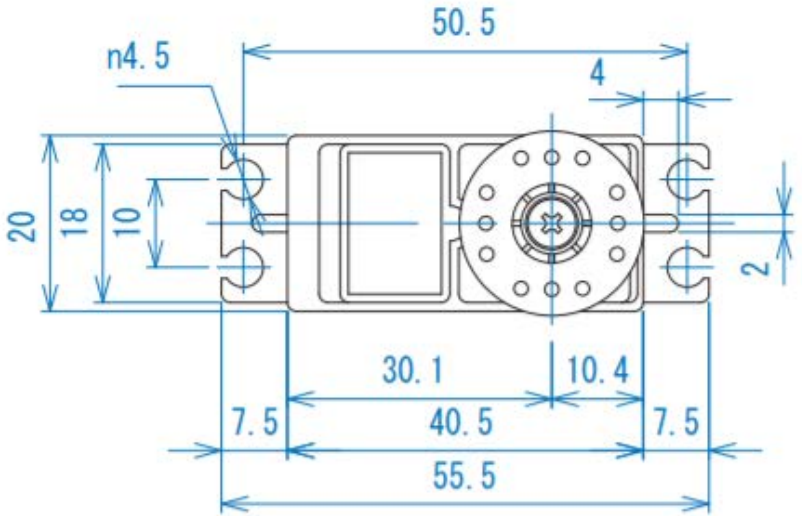


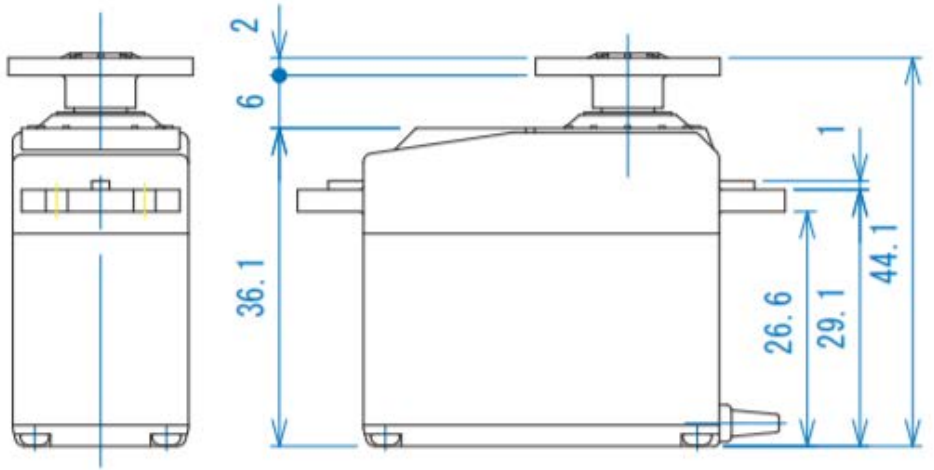
Fusion 360 (free for students)



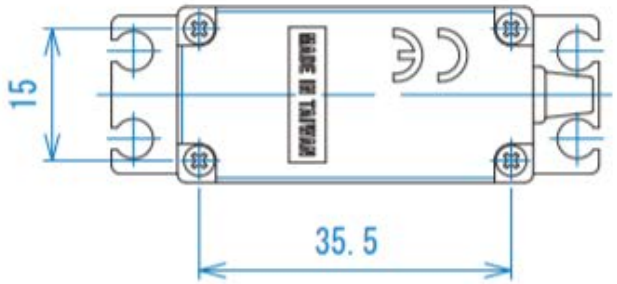
Sketching

Draw a mechanical sketch of the Parallax Continuous Rotation Servo





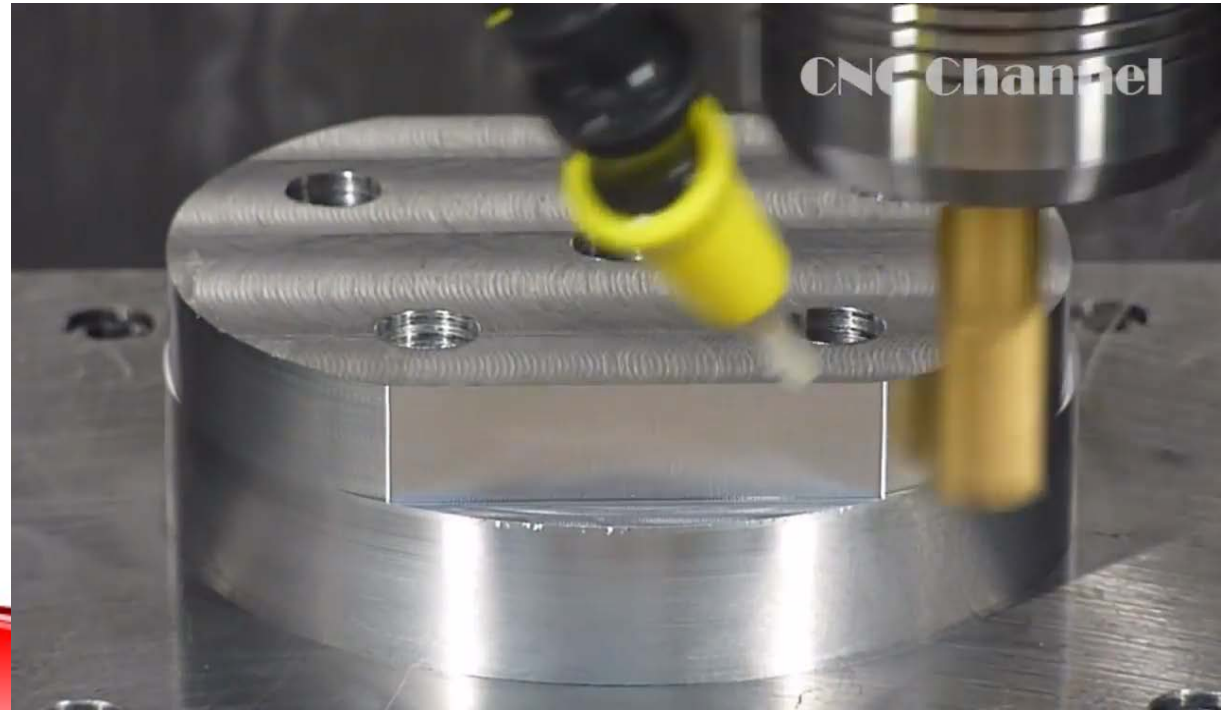
- Redundancy
- Missing dimensions
- Missing screw sizes



Fabrication Methods: CNC Milling

- Practically any material
  - Separate shops for wood and metal
- Achievable Tolerances
  - Depends on equipment, material, and time
    - Easy: ±0.005”
    - Medium: ±0.001”
    - Hard: ±. 0005-.0002”
- Cost
  - Material
  - Machinist avg. pay $18.82/hrs

- Emerson Manufacturing Lab (B40 Upson Hall)

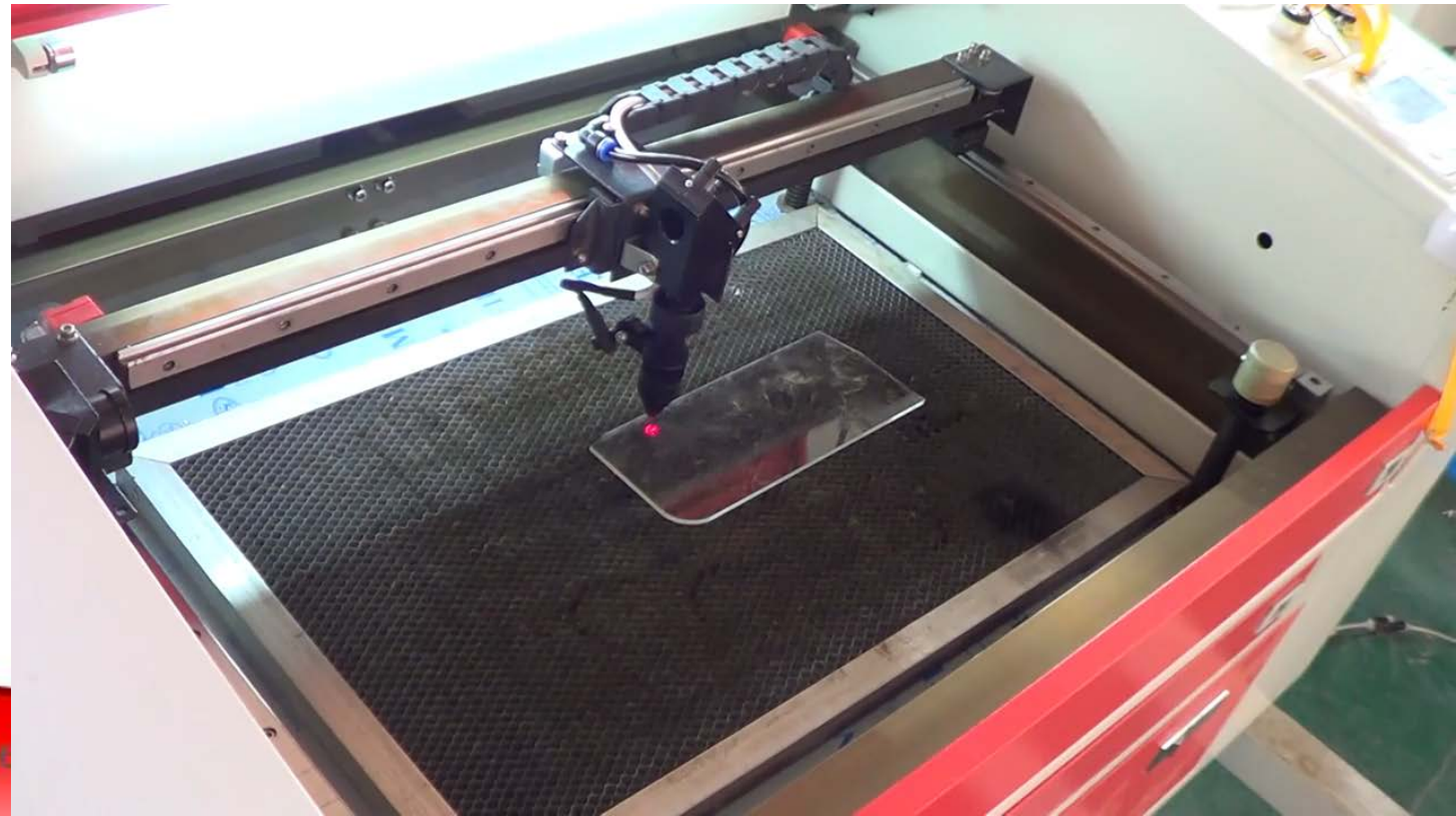


Fabrication Methods: Water Jet

- Practically any material
- Achievable Tolerances
  - Easy: ±0.002”
  - Doable: ±0.001”
- Advantages:
  - Fast
- Disadvantages:
  - Only 2D
  - Taper in the cut
  - Lead-in/out

Fabrication Methods: Laser Cutter

- PH414: 60W Epilog Laser Cutter and lots of acrylic stock
- Material
  - Max. thickness ¼”
  - Acrylic, cardboard, wood, etc.
  - No PVC, ABS, Styrofoam, epoxy, fiberglass!!!
  - Nothing reflective
- Advantages:
  - Very fast
- Disadvantages:
  - Only 2D
  - Taper in the cut



Fabrication Methods: 3D Printers

- PH414 (ZYYX printers), PH427 (Up! printer), Rapid Prototyping Lab
- Materials: ABS, PLA, (ninjaflex, metal, wood-filaments, etc.)

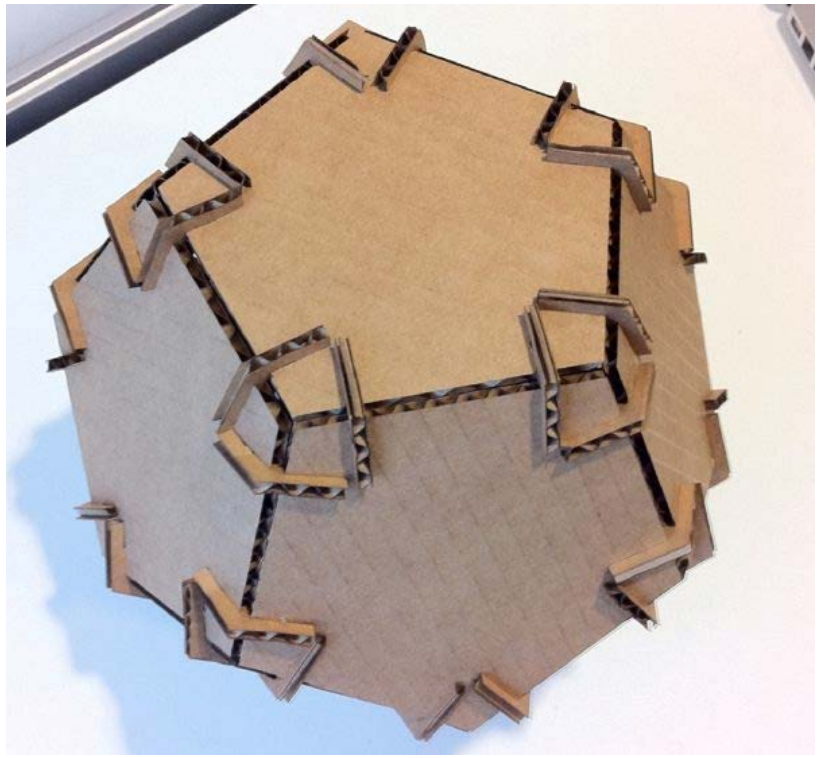
- Resolution (vertical):
  - UP!: 150um
  - ZYYX: 50um
  - Objet: 16um
  - Carbon3D: 10um
  - Nanoscribe: 1.5um
- Speed:
  - Slow (faster in XY dimension)
- Strength:
  - Direction dependent

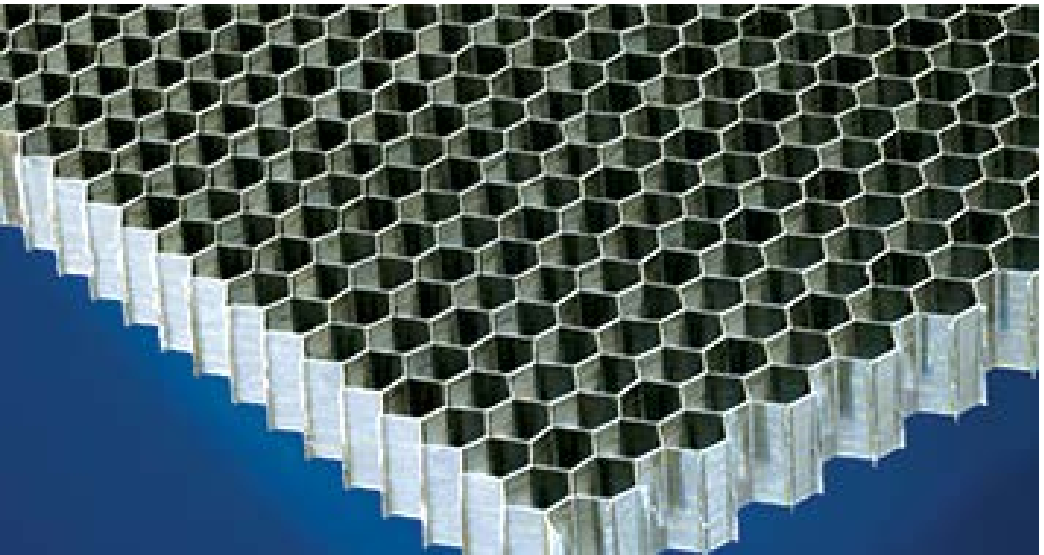
Fabrication Methods: Molding and Casting

- Materials: Silicone, acrylic resin/urethane foams, etc.
- Resolution: very good!
- Speed: Slow, but great if you want to make many parts

Fabrication Materials

- Cardboard
- Wood
- Acrylic
- Nylon
- ABS/PLA
- PVC
- Metal
- Carbon fiber
- Composites / non-uniform materials





Mechanical Prototyping 101: Fastening

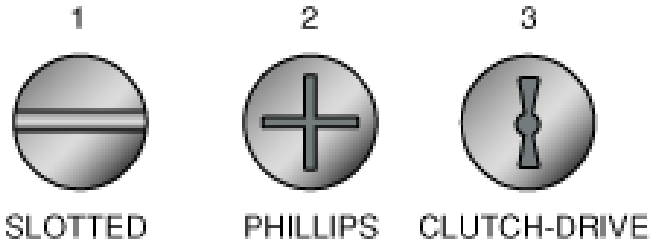
- Press-fit
- Screws
- Nails
- Glue

When to use what?

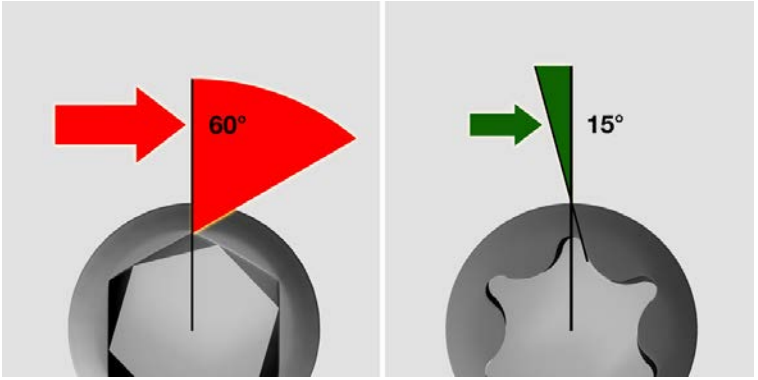
Mechanical Prototyping 101: Fastening

- Press-fit
- Screws
- Nails
- Glue

When to use what?



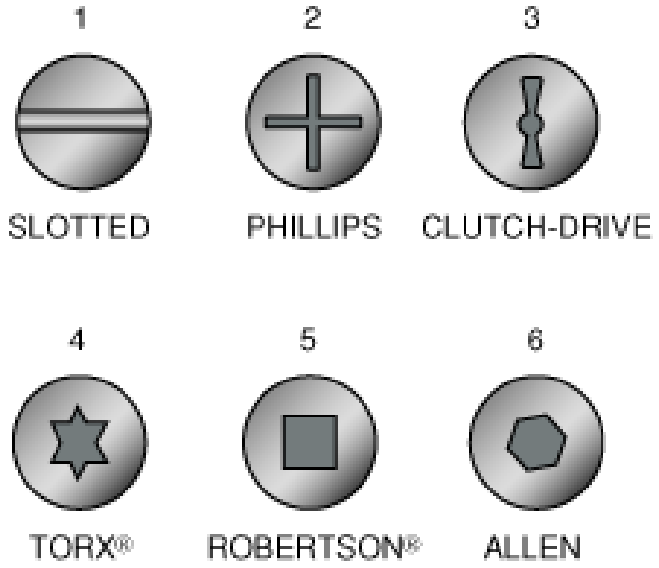
Screw Size	Major Diameter	Threads Per Inch	Minor Diameter	Tap Drill				Clearance Drill			
				75% Thread for Aluminum, Brass, & Plastics		50% Thread for Steel, Stainless, & Iron		Close Fit		Free Fit	
				Drill Size	Decimal Equiv.	Drill Size	Decimal Equiv.	Drill Size	Decimal Equiv.	Drill Size	Decimal Equiv.
0	.0600	80	.0447	3/64	.0469	55	.0520	52	.0635	50	.0700
1	.0730	64	.0538	53	.0595	1/16	.0625	48	.0760	46	.0810
		72	.0560	53	.0595	52	.0635				
2	.0860	56	.0641	50	.0700	49	.0730	43	.0890	41	.0960
		64	.0668	50	.0700	48	.0760				
3	.0990	48	.0734	47	.0785	44	.0860	37	.1040	35	.1100
		56	.0771	45	.0820	43	.0890				
4	.1120	40	.0813	43	.0890	41	.0960	32	.1160	30	.1285
		48	.0864	42	.0935	40	.0980				
5	.125	40	.0943	38	.1015	7/64	.1094	30	.1285	29	.1360
		44	.0971	37	.1040	35	.1100				
6	.138	32	.0997	36	.1065	32	.1160	27	.1440	25	.1495
		40	.1073	33	.1130	31	.1200				
8	.1640	32	.1257	29	.1360	27	.1440	18	.1695	16	.1770
		36	.1299	29	.1360	26	.1470				
10	.1900	24	.1389	25	.1495	20	.1610	9	.1960	7	.2010
		32	.1517	21	.1590	18	.1695				



Mechanical Prototyping 101: Fastening

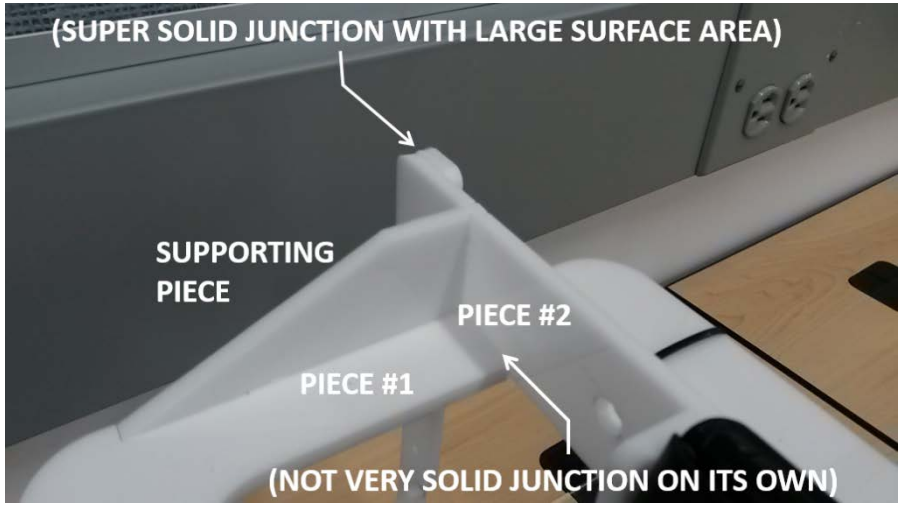
- Press-fit
- Screws
- Nails
- Glue

When to use what?



Mechanical Prototyping 101: Fastening

- Press-fit
- Screws
- Nails
- Glue
  - Hot glue
  - Instant glue
  - Wood glue
  - Elmer’s glue
  - Acrylic cement (Weld-on)



Formal Check-in:

- Either this (or the following) Friday

Open Lab:

- Saturday: 10am - 6pm
- Sunday 12-8pm
- …with full mazes

Go Build Robots!