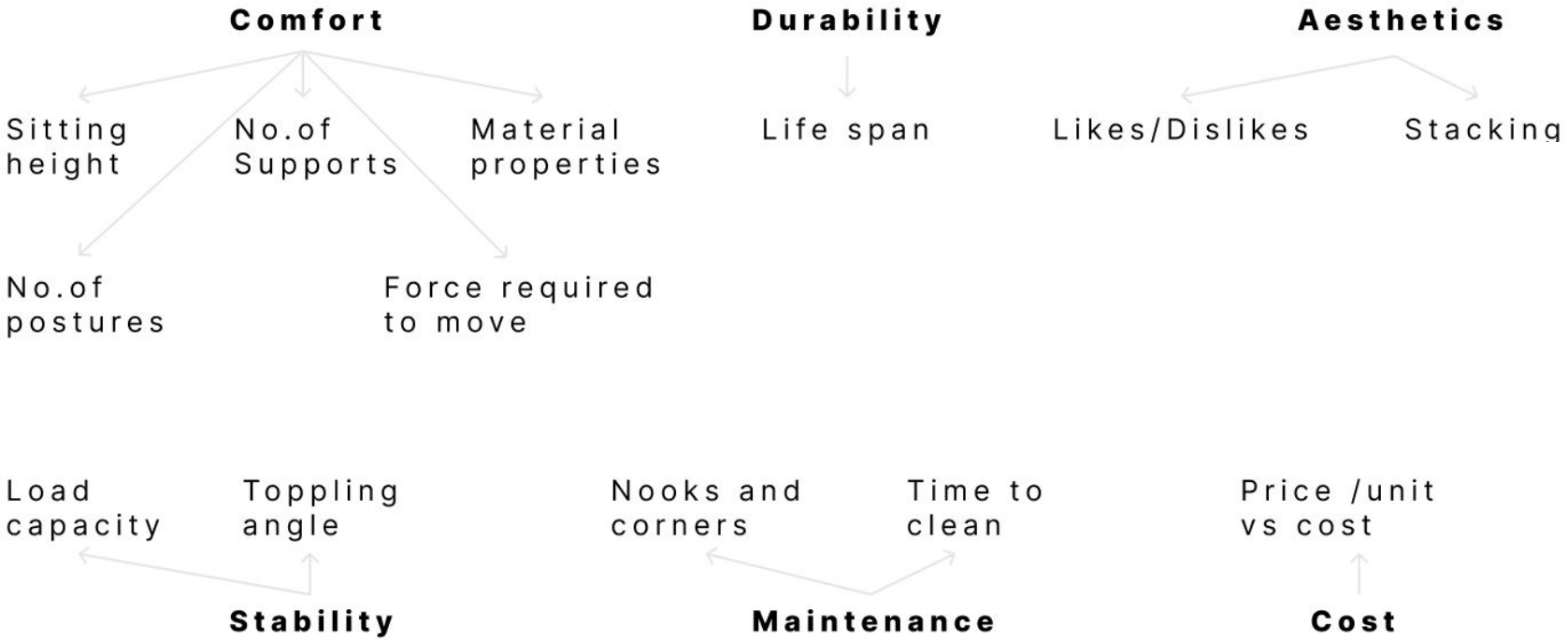
Zing Chair

0 | Requirements - Customer and Technical



Geometric	
Max. weight of the chair = 15kg + weight of the person ~150kg max.	D
Size of seat: 39-45 cm (depth) x 45 cm (width)	D
Height range(seat height from the floor)- 44-56.7 cm	D
Footrest, Height of support- 10 cm	W

Kinematics	
Moving on the chair should be at ease	D
Moving the chair should make less noise	W
Backrest adjustment mechanism	W

Forces	
Max. weight chair should support = 1650N	D
Density of the cushion = 1.6-2.4LB/cu.ft	D

Material	
Comfortable, breathable seat material	D
Durable framework	D

Safety	
Maximum load capacity	D
Chair must not topple	D
Should not have sharp edges	D

Operation	
Minimal noise	W
Comfortable to move	W

Maintenance	
Dust repellent seat-cover	W
Ease of servicing	W
Ease of repair/ replacements of parts	W
Ease of cleaning	W

Costs	
Total production cost must not exceed Rs. 5000	D

Assembly	
Minimal effort required	D
Sequential order to assemble	W

Transport	
Compact packaging	D
Weight reduction in packing	D
Ease of handling	W

Recycling	
Metals used can be recycled	W

1 | Embodiment determining requirements

Layout

- Seat with backrest supported by framework
- Framework enabling motion
- Foot rest at the bottom of the framework

Dimension

- Supporting framework, max. Load - 165 kg
- Seat dimensions - 39-45 x 45 cm
- Height of the seat from GL - 44-56 cm
- Height of the footrest from GL - 10 cm

Material

- Breathable seat cover material
- Strong and durable framework material
- Shock absorber with stiffness allowing smooth motion

1 | Problems identified in the current embodiment

More efforts required to rock the chair due to the stiffness of shock absorber

Looks anesthetic due to improper finishing

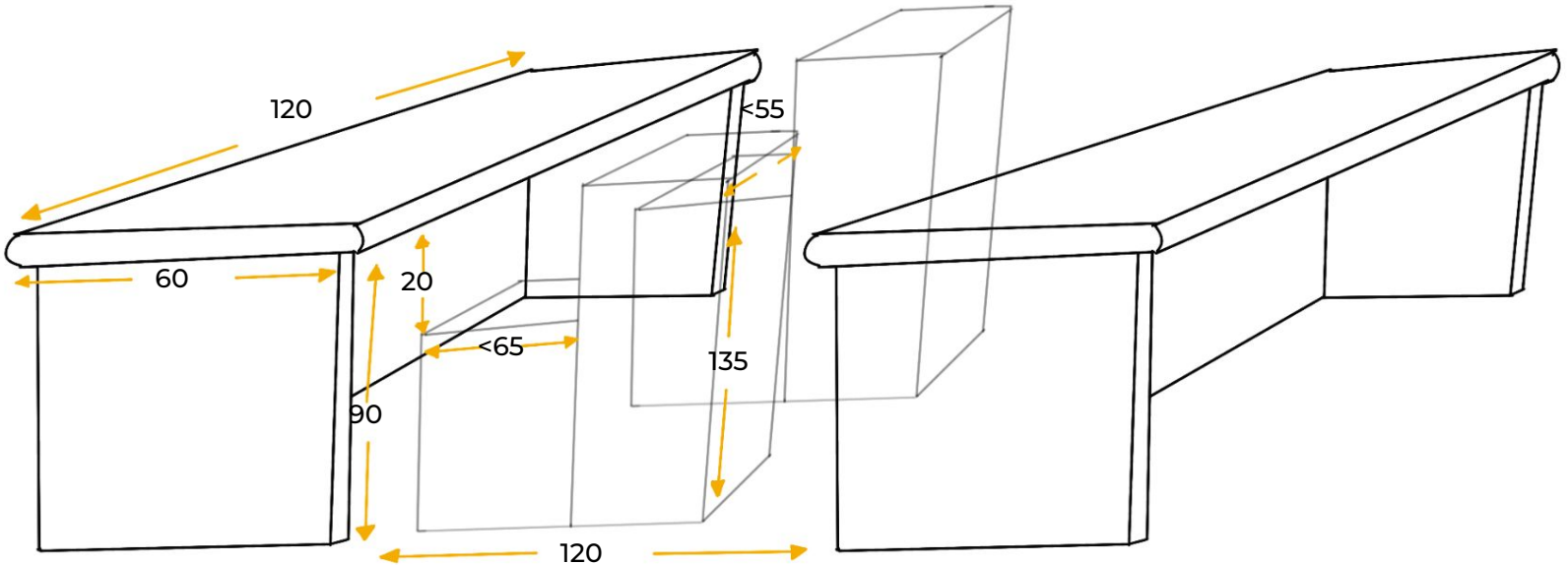
Bad cushion contour making the seated person slide

Discomfort caused due to instability

Instability caused due to deformed framework

2 | Spatial constraints

Note: All dimensions in cm,
Not to scale



3 | Embodiment determining main function carriers

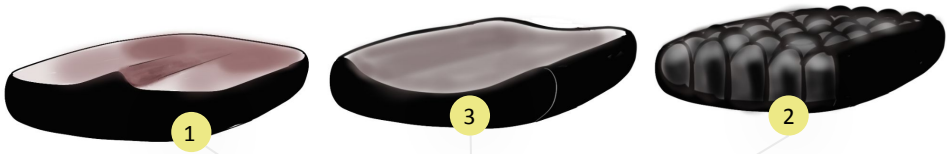
Main Function	Main function carrier	Designed/Bought-out
Human support	Seat	Designed
	Back rest	Designed
	Foot rest	Designed
Motion	Supporting frame	Designed
	Shock absorber	Bought-out
Stability	Supporting frame	Designed
	Base	Designed
	Shock absorber	Bought-out

3 | Embodiment determining main function carriers

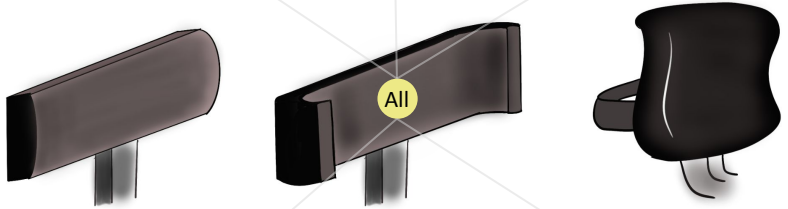
Main Function	Main function carrier	Designed/Bought-out
Comfort	Seat	Designed
	Cushion material	Bought-out
	Proportions	Designed
Durability	Materials	Bought-out
Aesthetics	Chair	Designed
Maintenance		Designed
Cost		Designed

4 | Preliminary scale layouts & form designs

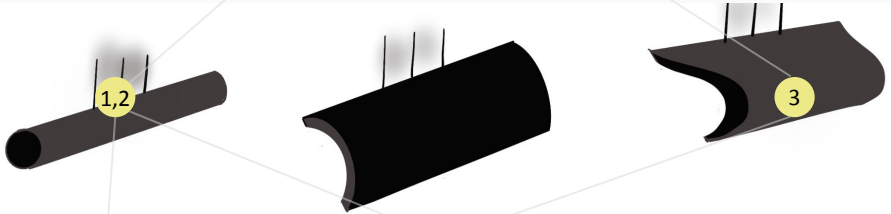
Seat
Principle of Stability



Back rest
Principle of stability

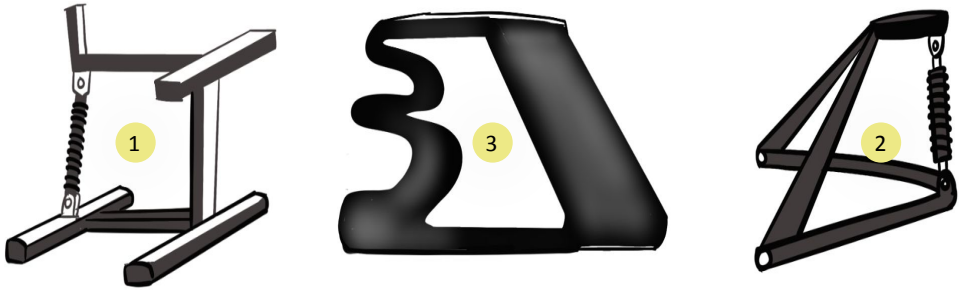


Foot rest



4 | Preliminary scale layouts & form designs

Supporting frame with base



5| Selection of the layout

Concept 01

Concept 02

Concept 03

5| Selection of the layout

#	Function	Working principle	Layout	Safety	Ergonomics	Production	Quality control	Assembly
1	✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✗	✗	✓	✗	✗	✓	✓

#	Transport	Operation	Maintenance	
1	✓	✓	✗	10
2	✓	✓	✗	10
3	✗	✓	✓	6

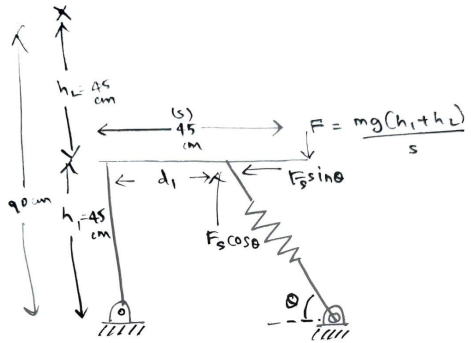
5| Selection of the layout

Concept 01

Concept 02

Concept 03

5| Selection of the layout



Here, $F_s \cos\theta \cdot d_1 + F_s \sin\theta \cdot h_1 = mg(h_1+h_2)$

$F_s = kx = 4900 \times \frac{5.61}{100} = 274.89N.$

(Assuming, 82001 model no.)

ex. $l = 15.98$

c. $l = 10.37$

(Assume, $k = 4900 N/m$.)

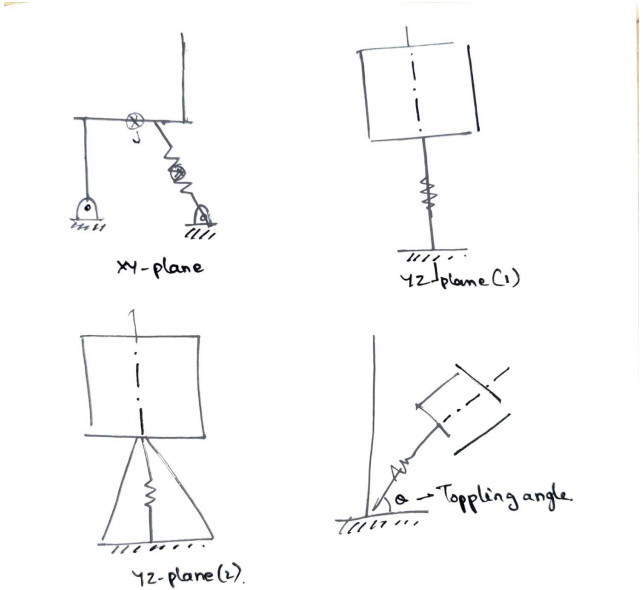
$\Rightarrow (274.89 \times \cos 60^\circ \times 0.45(\cot 60^\circ)) + (274.89 \times \sin 60^\circ \times 0.45) = 0.45 \times (10^\circ) \times m.$

~~$m = 1184.3$~~ $45m = 99.25$

$m = 22 kg.$

~~upto 220 kg~~ N.

5| Selection of the layout



5| Selection of the layout

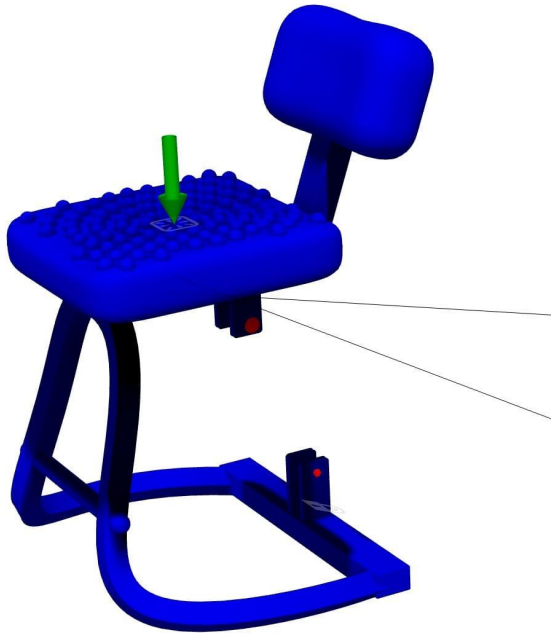
5| FEA

We tried to apply a maximum pressure of 0.01744 pa.

The total area of the seat is 0.08614 meter square.

We applied a vertical force of 1500N.

Then, applied constraints of load to both the connecting bolts.



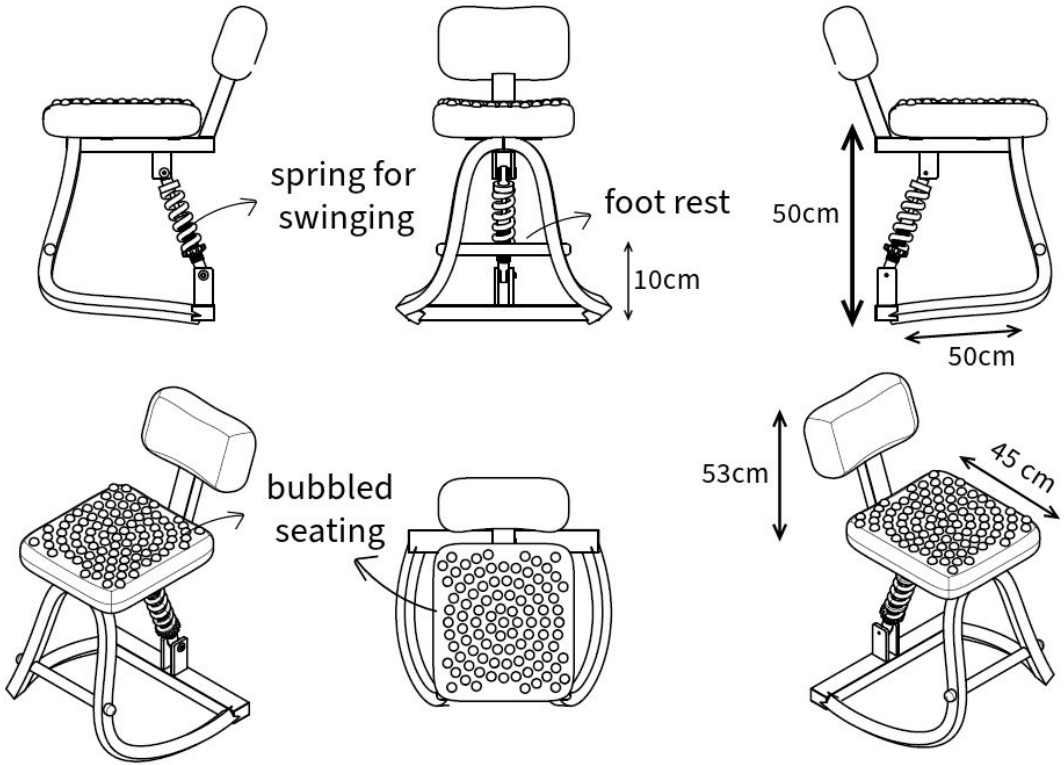
5| Selection of the layout

Concept 01

Concept 02

Concept 03

5 | Preliminary layout



7 | Essential auxiliary functions

Main function carrier	Auxiliary function	Auxiliary function carrier
Seat	Protects	Seat cover
Back rest	Supported by frame	Bolts
	Attaches back rest to cover	Staples
Foot rest	Attached to frame	Welded
Supporting frame with base	Supports seat	Bolts

7 | Essential auxiliary functions

Main function carrier	Auxiliary function	Auxiliary function carrier
Supporting frame with base	Supports itself	Bolts and Pivot plate, Welded
	To base	Welded
	Suspension	Bolts and Pivot

7 | Essential auxiliary functions

Leather

Chenille

Polyester

Velvet

Acrylic

7 | Essential auxiliary functions

+9 colours/patterns

Rpi shop - 200 Pcs Set, M8 x 20mm Hex Head Screws, Hex Head bolt With Nut & Washer, Zinc-Coated (50 Pcs Each)

★★★★☆ ˇ 118

₹660 (₹3.30/count) M.R.P: ~~₹960~~ (31% off)

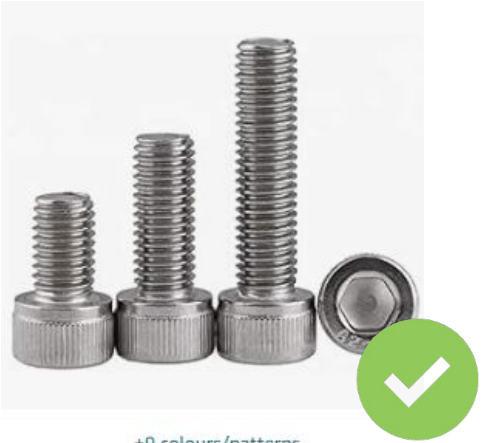
INR 11/piece

SYLIX ® M4 x 12mm Length Button Head Socket Cap Screws, Stainless Steel, Bright Finish, | Allen Button Head Bolt With Nut & Washer (10...

★★★★★ ˇ 4

₹350 M.R.P: ~~₹506~~ (31% off)

INR 35/piece



+9 colours/patterns

Rpi shop - M4 x 12mm Stainless Steel Socket Head Cap Screws, Allen Socket Drive,Fully Thread, Bright Finish, Machine Thread, Quantity -...

★★★★½ ˇ 91

₹195 (₹19.50/count) M.R.P: ~~₹495~~ (61% off)

INR 19.5/piece

7 | Essential auxiliary functions

INR 35/piece

INR 19.5/piece

INR 11/piece

8 | Design for Aesthetics

Visual Information

Market & User information:
For Educational institutions; Students, Lecturers, Research scholars, VIPs

Purpose information:
Active seating
Foot rest

Expression

Stable	Comfortable
Allows motion	Dignified
Light weight	

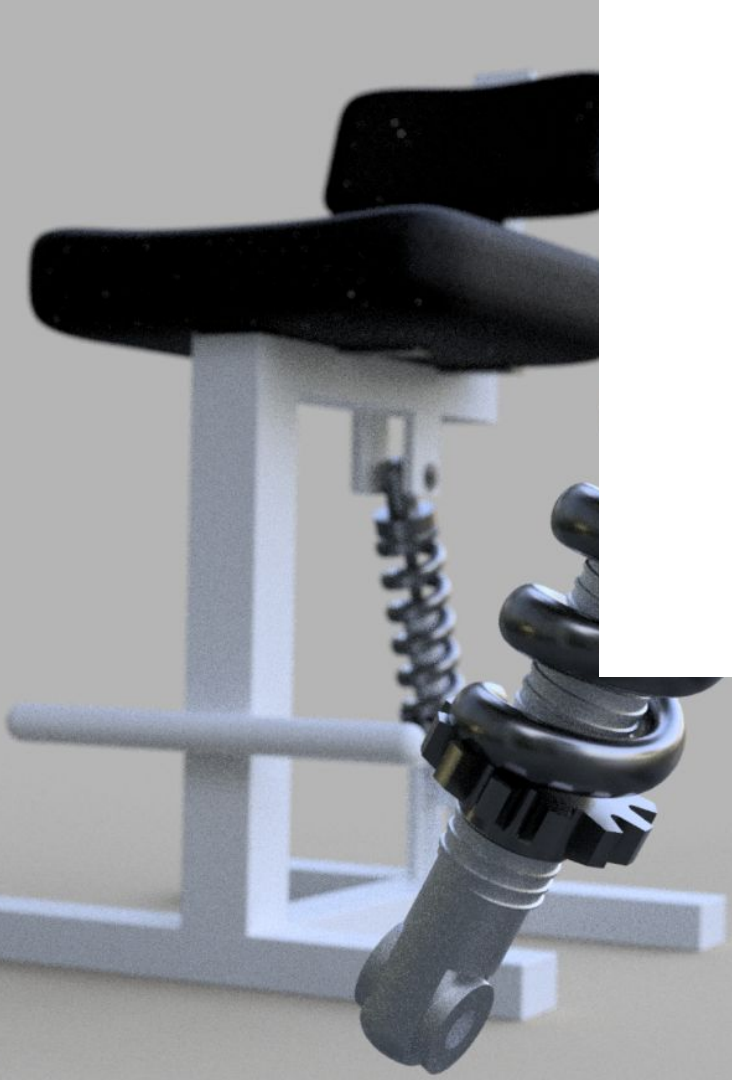
8 | Design for Aesthetics

9 | BOM

Component	Cost (INR)
60 x 40 pipe, 14 gauge	1200/20’
40 x 40 pipe, 16 gauge	250/kg
1” round, mild steel CR	150
1” bolts (6) + 3” bolt (2)	60
12mm Plywood 3’ x 2’	110/sq .ft
5mm Cushion	550
Bubbled seat	Upto 1000
Shock absorber	1650
labour charges	1200
m4*12mm head cap screws	19/unit
Acrylic spray paint	300

INR **6345**

9 | Detailed layout



Principles of Embodiment

Zing Chair

Harun Vignesh
Hemanth G N
Nishita Sree

#1

Principles of Force Transmission

Uniform Strength

Tennis Racket

The frame is stiffer near the head, flexible near the handle to manage the stress along these flowlines. This optimizes racket control and power transfer while minimizing frame deformation.

Direct & Short Force Transmission Path

Screwdriver

The handle transmits torque directly to the screw head through a straight shaft, minimizing effort and maximizing torque transfer

Matched Deformation

Suspension

Springs and dampers are carefully chosen to deform together, ensuring smooth and controlled suspension movement over uneven terrain.

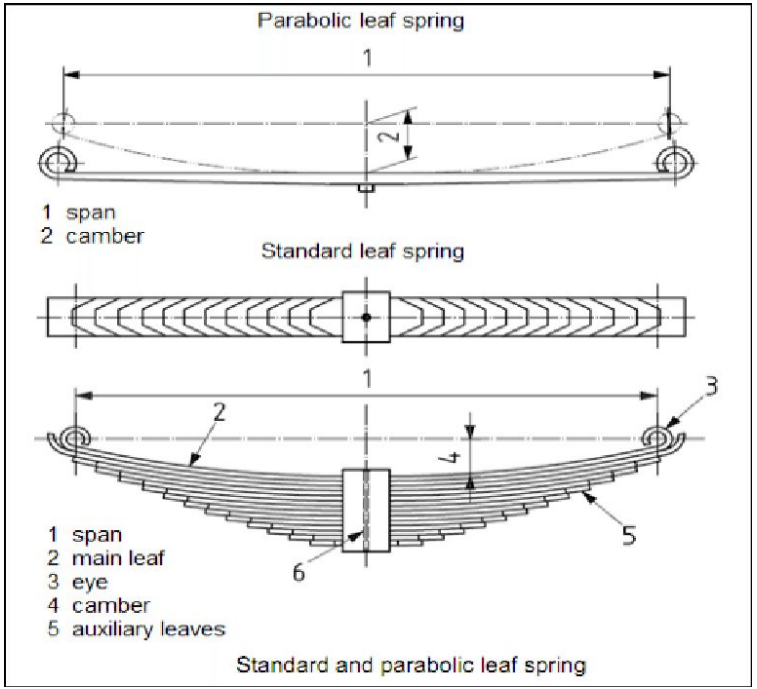
#1

Principles of Force Transmission

Uniform Strength

Leaf spring suspension

The frame is stiffer near the head, flexible near the handle to manage the stress along these flowlines. This optimizes racket control and power transfer while minimizing frame deformation.



Standard and parabolic leaf spring

#1

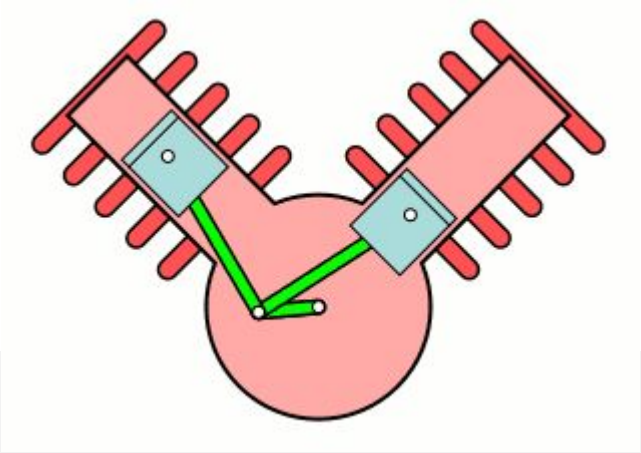
Principles of Force Transmission

Balanced Forces

V Configuration engines

Counterbalances each other

Reduces need for extra balancing elements



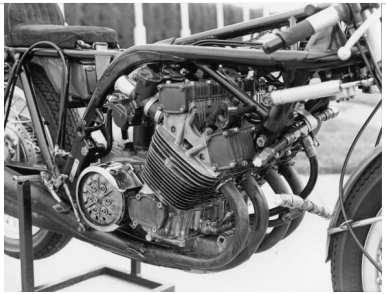
#2

Principles of Division of Tasks

Assignment of Subfunctions

Engine as structural member

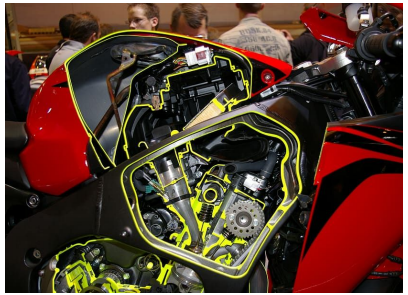
Internal combustion engines due to their sturdy construction can be used as structural member in a two-wheeler chassis. Hence fulfils several functions in one carrier



Division of tasks for distinct functions

Fuel tank placement

Subfunctions: Capture image, process image, store image, display image. Assigned components: Lens, sensor, processor, memory, screen.



Division of tasks for identical functions

Extra motors for drivetrain

Extra motors engage only when the performance is demanded. For nominal usage the extra motors remain turned off

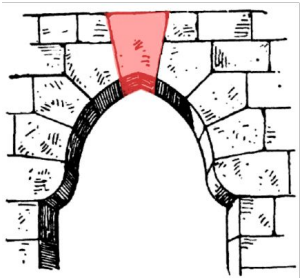
#4

Principles of Stability & Bi-stability

Stability

Keystone

Keystone in arches cancels out the effects of disturbances



Bi-stability

Switch

Toggle switch has two stable states as two distinct positions “on” and “off”

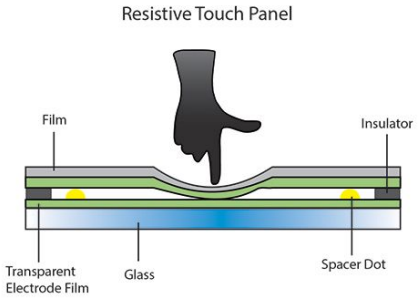
#5

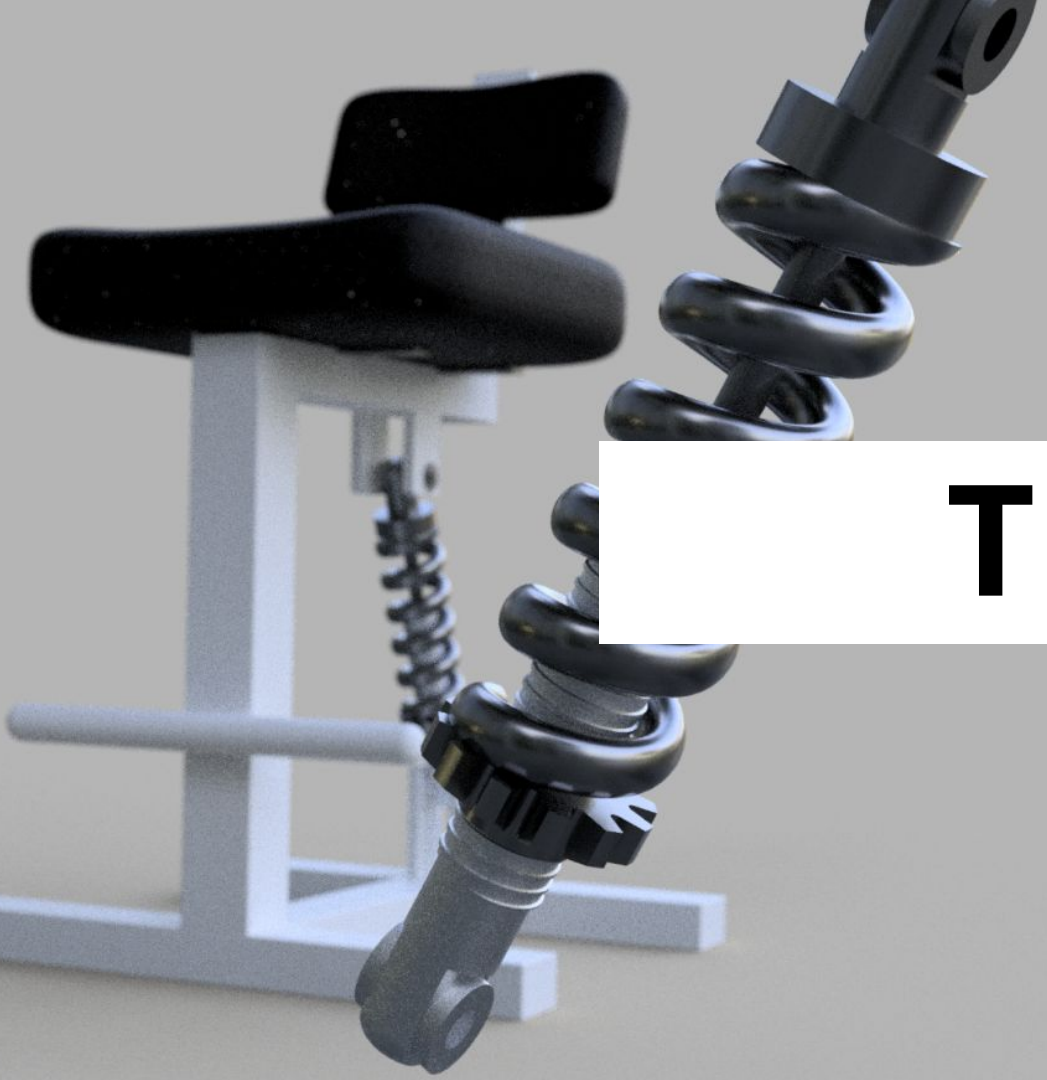
Principles of Fault free design

Fault-free design

Capacitive touch screens

Simplification of technology combining interaction and information display together





Thank you

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