

# Choosing electric motors

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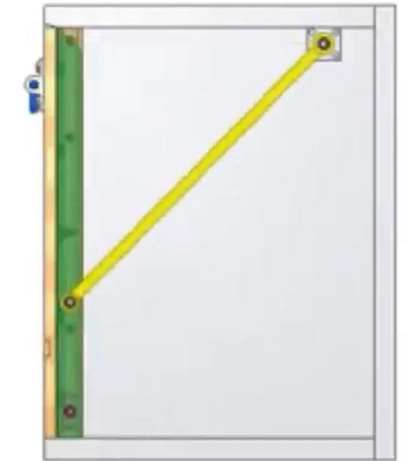
# Scenario 1

- Arm with position control to open and close a box
- Specifications:
  - Weight of the door: 500g
  - Weight of arm and cables: 100g
  - Length of arm: 50cm
  - Continuous motion over  $45^\circ$  in 2s
  - 9V power supply
  - Max. motor diameter: irrelevant
  - Weight: irrelevant



# Scenario 1

- Design implications:
  - Continuous motion: DC motor, not stepper
  - Low speed application: high gear reduction
- Motor Parameters:
  - $(0.5 \text{ m} * 0.5 \text{ kg} + 0.25 \text{ m} * 0.1 \text{ kg})$
  - \*  $9.81 \text{ m/s}^2 = 2.7 \text{ Nm}$  (~27.5 kg-cm)
  - Min. speed:  $0.125 \text{ rev} / 0.033 \text{ min} = 3.8 \text{ rpm}$

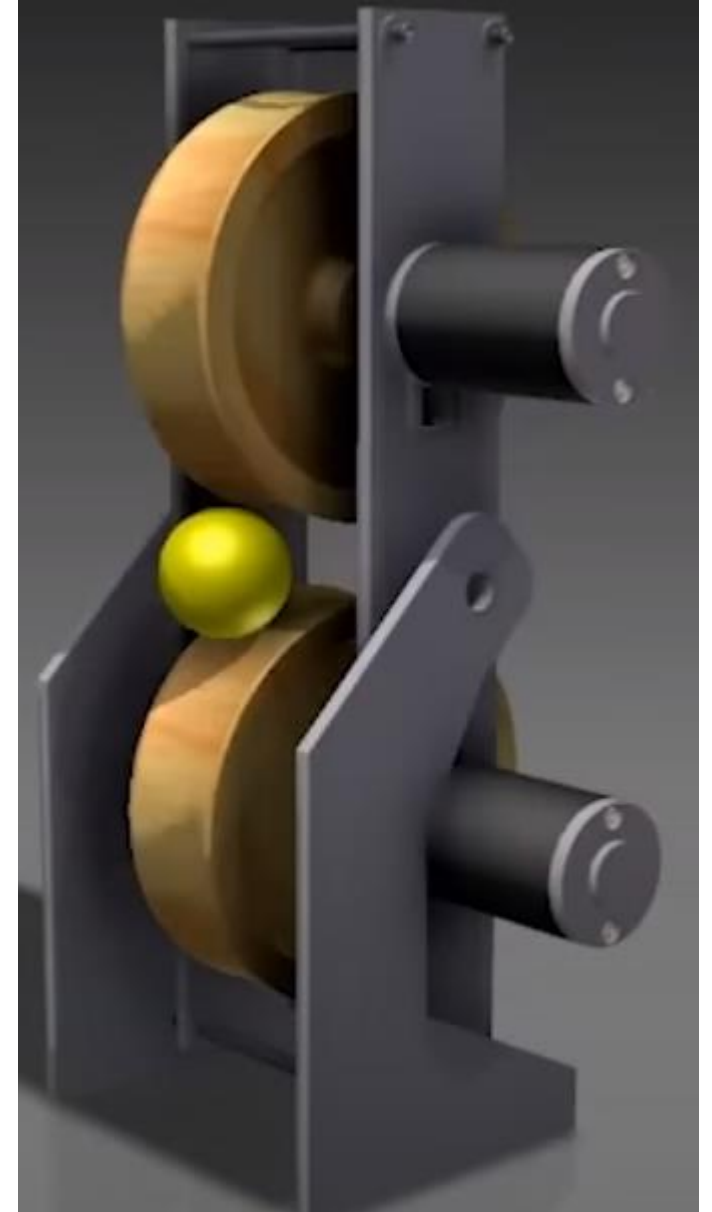


# Scenario 1



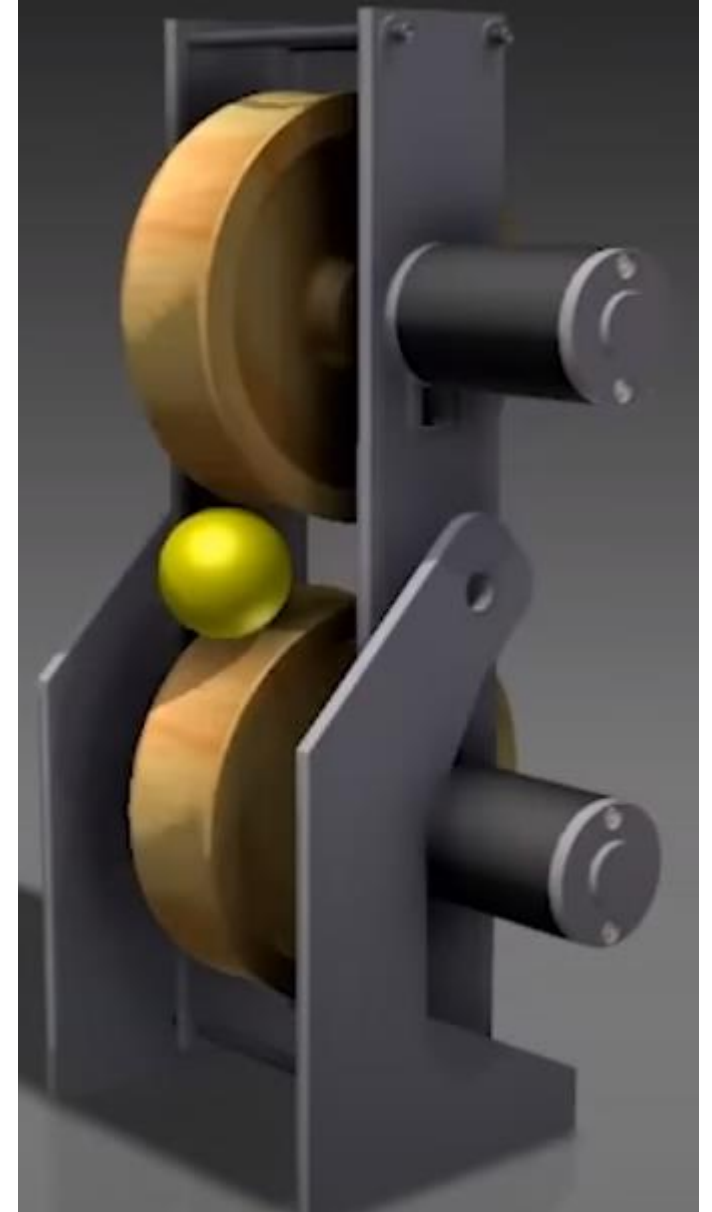
# Scenario 2

- Tennis ball thrower
- Specifications:
  - Disk dia.: 20cm
  - Min. ball speed: 50km/h
  - 12V power supply
  - Req. force applied on the ball: 1.5N
  - Continuous motion
  - Motor diameter: irrelevant
  - Weight: irrelevant



# Scenario 2

- Design implications:
  - Continuous motion
  - High speed, low torque
- Speed
  - $\frac{\frac{50}{3.6}}{0.1} = 139 \frac{rad}{s}, \frac{278}{2*\pi} * 60 = 1326 rpm$
- Torque:
  - $\frac{1.5}{2} * 0.2 = 0.15 Nm (\sim 1.5 kgcm)$



# Scenario 2