

Couplings

A flexible coupling (bellows) makes it possible to

- ☒ **Correct the alignment between the axes to be coupled**
- ☐ To improve the guidance of the axes to be coupled
- ☐ To reduce the play between the two axes to be coupled
- ☐ To reduce the inertia of the transmission
- ☐ None of the other proposals

Choice transmission

For the realization of a machine tool axis of 400mm, you recommend a transmission:

- ☐ with a rigid belt TCH-XX
- ☒ **with a screw-nut transmission**
- ☐ with rack-pinions
- ☐ None of the other proposals

Choice of transmission

For the implementation of the axes of a machine of laser cutting of 2mX3m, it is preferable to use:

- ☐ A belt
- ☐ Screw transmission
- ☒ **Rack-pinion transmission**
- ☐ Crank transmission
- ☐ Cable transmission

Direct drive

A direct drive (DD) axis (direct actuation) is a motorized axis without reducer. Check the correct answer(s)

- ☒ **A DD is more sensitive to external disturbances**
- ☐ A solution with DD axes induces more mechanical noise and requires lubrication
- ☒ **The absence of a reduction gear induces better mechanical reliability.**
- ☐ The absence of a reducer makes the system more fragile.
- ☒ **A DD solution has a better natural frequency (better means higher)**

Recirculating Ball guideways

The balls of a recirculating ball guide

- ☐ **reduce friction**
- ☐ **improve rigidity**
- ☐ reduce manufacturing costs
- ☐ **make the implementation more compact**

Guideways

For the implementation of a linear guide with a small stroke (<10 mm) and without backlash, it is preferable to use:

- ☐ **A guide with flexible blades (flexible hinges' guideway)**
- ☐ A guide with ball bearings
- ☐ An Igus dry guide
- ☐ A Hydrostatic guide
- ☐ None of the other proposals

Backlash

Consider a planetary gearbox with 1 degree of mechanical backlash, controlling a 300 mm long arm- The backlash at the tip of the arm is approximately:

- ☐ **5 mm**
- ☐ 1.67 mm
- ☐ 300 microns
- ☐ 10 mm

Materials

To improve the eigen frequency of an arm, it is preferable to choose

- ☐ An aluminum alloy
- ☐ A steel alloy
- ☐ A Magnesium alloy
- ☐ A Titanium alloy
- ☐ **The choice is not decisive**

Reducers

For the implementation of a rotary axis **without backlash**, it is recommended to use:

- ☒ a Harmonic Drive reducer, if the reduction ratio is low, by low we mean <300
- ☐ a Harmonic Drive reducer, if the reduction ratio is high
- ☐ a belt reducer, if the reduction ratio is low
- ☐ a belt reducer, if the reduction ratio is high

Spring

A spring mechanism is recommended in a screw transmission to

- ☒ reduce the mechanical play in the transmission
- ☐ reduce the friction in the transmission
- ☐ increase the natural frequency of the mechanism
- ☐ make the system oscillatory

Spring

The use of a preload spring induces the following behavior(s)

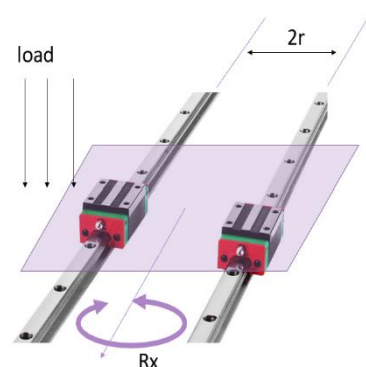
- ☒ It increases the friction in the mechanism
- ☐ It reduces the friction in the mechanism
- ☒ It reduces the mechanical backlash in the mechanism
- ☐ It makes the mechanism simpler

Rigidity - guideways

Given the construction of a guide with double linear rails, distant by $(2r)$

The torsional stiffness (in the Rx direction) is then:

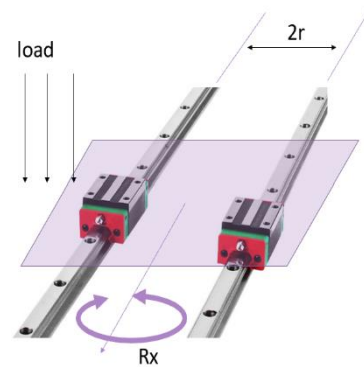
- ☒ Proportional to r^2
- ☐ Proportional to r
- ☐ inversely proportional to r^2
- ☐ inversely proportional to r



Rigidity - guideways

Given the construction of a guide with double linear rails, distant by $(2r)$

This construction has the following characteristics:



- | |
|--|
| <input type="checkbox"/> Allows better torsional rigidity in the Rx axis |
| <input type="checkbox"/> Allows better rigidity in the vertical direction |
| <input type="checkbox"/> Allows better torsional rigidity in the axis Rx but weakens the stiffness in the direction of the load. |
| <input type="checkbox"/> Allows better rigidity in the direction of the load but weakens the torsional rigidity in the Rx axis |
| <input type="checkbox"/> Is hyperguided |

Cable transmission

A cable transmission is recommended in the implementation of haptic devices because of

- | |
|---|
| <input type="checkbox"/> its very good mechanical performance (efficiency) |
| <input type="checkbox"/> its very good reversibility |
| <input type="checkbox"/> its very low friction |
| <input type="checkbox"/> its very compact implementation |
| <input type="checkbox"/> The stiffness of the cable |

Belt transmission

A belt transmission is recommended in the case of:

- | |
|--|
| <input type="radio"/> Rapid movements |
| <input type="radio"/> Precise movements |
| <input type="radio"/> movements requiring great forces |

rack-and-pinion

A rack-pinion transmission is recommended for:

- | |
|--|
| <input type="checkbox"/> rapid movements |
| <input type="checkbox"/> precise movements (because of the stiffness of rack pinions transmissions (at the condition that the back lash is well compensated)) |
| <input type="checkbox"/> movements requiring great forces |

screw

A Screw transmission is recommended for:

- ☐ rapid movements
- ☒ **precise movements (at the condition that the back lash is well compensated)**
- ☒ **movements requiring great forces**

Ball screws

The Balls of a ball screw transmissions allow to:

- ☐ Reduce the manufacturing cost
- ☐ Improve the compactness of the screw
- ☒ **Reduce the friction**
- ☒ **Improves mechanical reversibility**
- ☐ None of the other proposals.

Biocompatible materials

Stainless steel is biocompatible

- ☐ True
- ☒ **False**

Quality factor

Quality factor introduced by Dr. Marc Olivier Demaurex makes it possible to compare the performance of robots regardless of their size.

- ☒ **True**
- ☐ False

Ball guideways

The balls of a recirculating ball guide reduce friction.

- ☒ **True**
- ☐ False

Materials

For the construction of a rigid arm, a steel alloy is preferable to an aluminum alloy

☐ True

☐ False

Precision

The higher the natural frequency, the better the positioning precision of a robot arm .

☐ True

☐ False

Precision

For reducing the positioning error of a robot arm, a bang-bang acceleration profile is better than a sinusoidal acceleration profile

☐ True

☒ False

Reducers

A planetary gearbox can achieve (implement) higher reduction ratios than a Harmonic Drive

☐ True

☐ False

Reducers

A Harmonic Drive reducer is more rigid than a planetary reducer

☐ True

☒ False

Springs

A spring is recommended to dampen oscillatory behavior,

☐ True

☒ False

Trajectories

The profile acceleration has no effect on the position accuracy of a robot arm.

☐ True

☒ False

Cable transmissions

A cable transmission is recommended in the implementation of haptic devices

☒ True

☐ False

Cable transmissions

Cable and belt transmissions have comparable efficiencies

☒ True

☐ False

Ball screws

Ball screw transmissions are chosen because of their lower manufacturing cost

☐ True

☒ False