Mechanics and Machines, Lecture 2

Types of drives: kinematics, where to find other info

Drives: friction, belts, chains, gears, universal, geneva

Innopolis University

Goal of the lecture

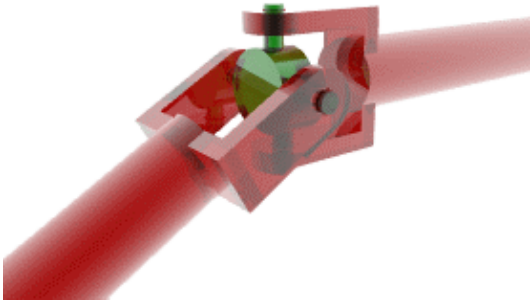
Make an overview of typical drives.

Give a hint how to work with it.

Explain how to find information about particular drive.

Universal Joint

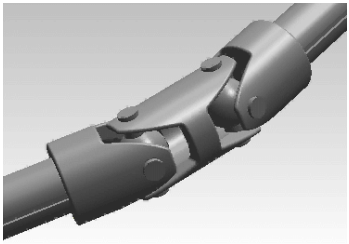
Visualisation



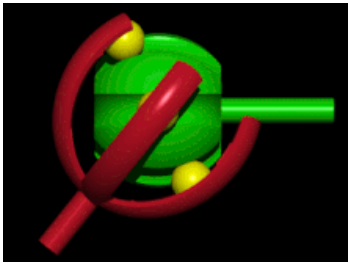
Universal Joint

Types of universal joint

Cardan



Double cardan joint



Constant-velocity universal ball joint

Universal Joint

Drive kinematics (1)

Angle relationship — $\tan(\psi) = \tan(\psi')\cos(\beta)$

Angular velocities relationship —

$\omega\cos(\beta) = \omega'(\sin^2(\psi) + \cos^2(\psi)\cos^2(\beta))$

Universal Joint

Features and facts

- It’s effective tool for transferring a torque for max 30 degrees.
- Constant-velocity universal ball joint (шрус) is not a small device and it’s not easy to find it (it can be found as a car detail).

Universal Joint

What can be interesting to find (queries)

1. Correlation between velocities and angle between links in Universal joint
2. Cardan dynamics

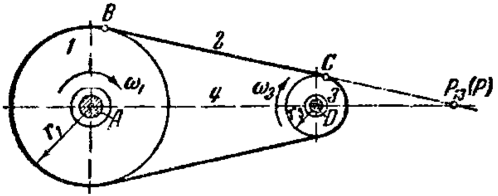
Universal Joint

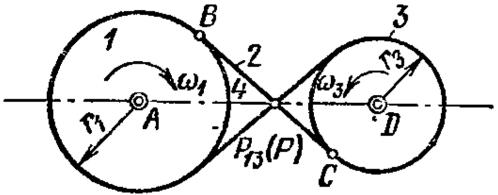
Reference material

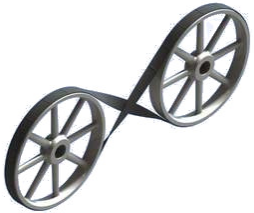
1. **Other names**: cardan joint, Hooke's joint, кардан, универсальный шарнир
2. Universal joint (wiki)
3. *"Теория механизмов и машин" Артоболевский И. И. 1988, pdf pages 168–172*
4. Find U-joint parameters using quaternions
5. Dynamics of universal joints

Belt

Visualisation







Belt

Types of belt transmission

Belt

Drive kinematics (1)

Belt

Drive kinematics (2)

Belt

What can be interesting to find (queries)

Belt

Reference material

Chain

Visualisation

Chain

Types of chain transmissions

Chain

Drive kinematics (1)

Chain

Drive kinematics (2)

Chain

What can be interesting to find (queries)

Chain

Reference material

Geneva drive

Visualisation

Geneva drive

Types of geneva drive

Geneva drive

Drive kinematics (1)

Geneva drive

Drive kinematics (2)

Geneva drive

What can be interesting to find (queries)

Geneva drive

Reference material

Friction drive

Visualisation

Friction drive

Types of friction drive

Friction drive

Drive kinematics (1)

Friction drive

Drive kinematics (2)

Friction drive

What can be interesting to find (queries)

Friction drive

Reference material

Gears

Visualisation

Gears

Types of Gears

Gears

Drive kinematics (1)

Gears

Drive kinematics (2)

Gears

What can be interesting to find (queries)

Gears

Reference material

Reference material

- *"Mechanisms and Machines: Kinematics, Dynamics, and Synthesis" Michael M. Stanisic, pdf pages 21–56* **1.1 — 1.6**
- *"Theory of Machines and Mechanisms" John J. Uicker, pdf pages 33–59* **1.4 — 1.7**
- *"Design of machinery" Robert L. Norton, pdf pages 57–79* **2.0 — 2.11**
- *"Механика. Теория механизмов и машин" Конищева О. В., pdf pages 7–23*
  Структурный анализ и классификация плоских механизмов
- *"Теория механизмов и машин" Артоболевский И. И. 1988, pdf pages 21–63*
  Структурный анализ и классификация механизмов

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