



Introduction to Mechanical Engineering, Lecture 4

Links, Joints, Connections

Shafts, Axles, Shafts couplings

Bearings



Mechanism





What does the mechanism consist of?

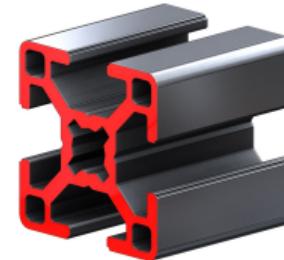
- Links
- Joints
- Connections: permanent and detachable

Links

Types (my classification)



Sheet (Листовой материал): plywood (фанера)



Profile (профиль): T-slot (Конструкционный профиль)



Beam (Брус): al. bar (ал. брус)



Plate (плита): Aluminum billet (Заготовки)



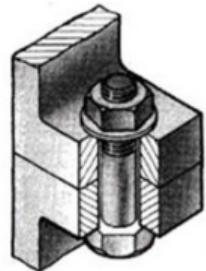
Joints

More info in [Lecture 3](#)

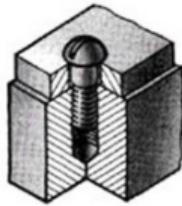


Connections

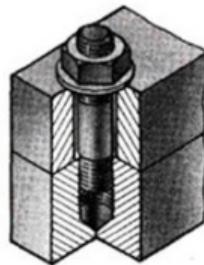
Classification



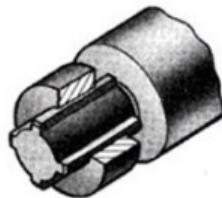
боловое



винтовое



шпилечное



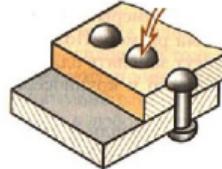
шлифтовое



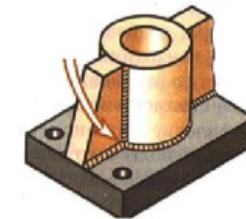
шпоночное



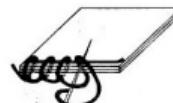
штифтовое



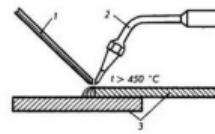
клепаное



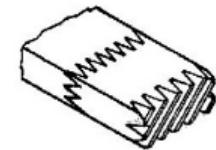
сварное



шивное



паяное



клеевое

Detachable (Разъемные)

Permanent (Неразъемные)



Shaft (Вал), Spindle (Шпиндель), Axle (Ось)

Video





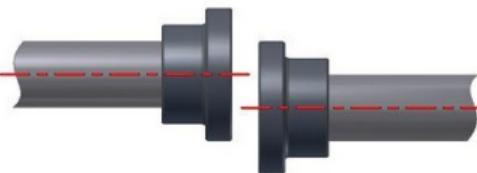
Shaft Coupling

Intro

The shaft coupling is referred to as that mechanical component which is most commonly used for the purpose of *connecting two rotating shafts* like the driving shaft in order to let the driven shaft work for purpose of *transmitting power*.

Types of misalignment

- Offset



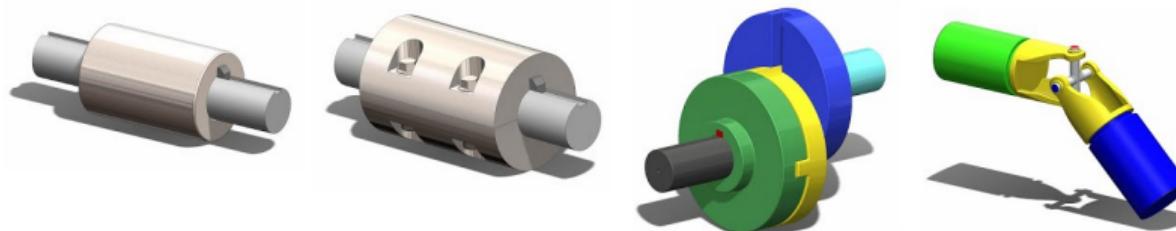
- Angular





Shaft Coupling

Video



Shaft Couplings
[**Intro, Classifications, Animations**](#)





Types of shaft couplings



Sleeve Coupling



Split-Muff Coupling



Flanged Coupling



Flexible Coupling



Oldham Coupling



Universal Coupling



Gear Coupling



Fluid Coupling



Practical usage of Shaft Couplings

Video

МУФТЫ





Shafts + Shaft Couplings

Reference material

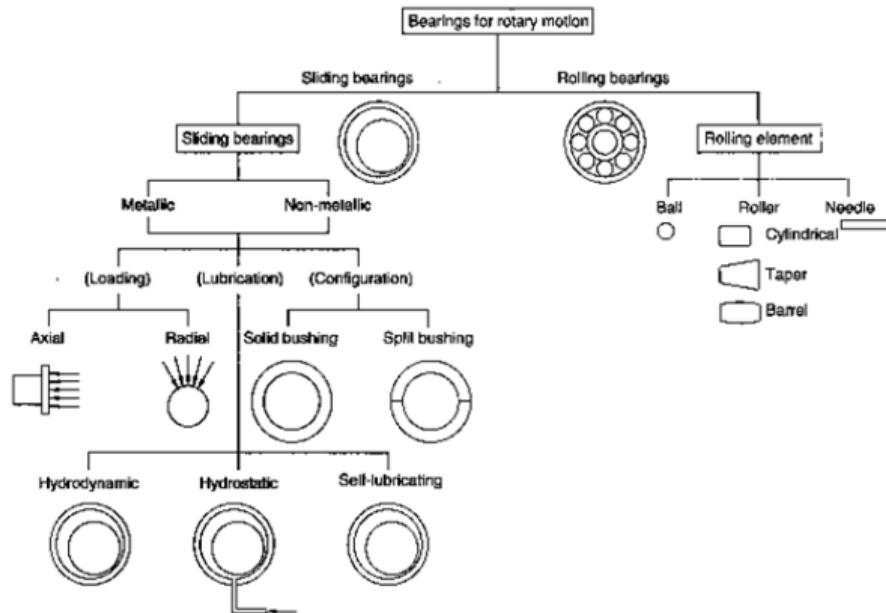
- Shafts (video, rus)
- Classification of couplings, Types of couplings, Coupling types (Indian, video)
- Text material about shaft couplings



Bearings

Definition

Bearing is a machine element that *constrains relative motions* and is used to *reduce the friction* between moving parts.





Bearings

What we should cover

- Types, prof and cons
- How to mount and dismount them on shaft
- How to fix it on outer body (Bearing housing)



Rotary Bearings

Video





Linear Ball Bearings

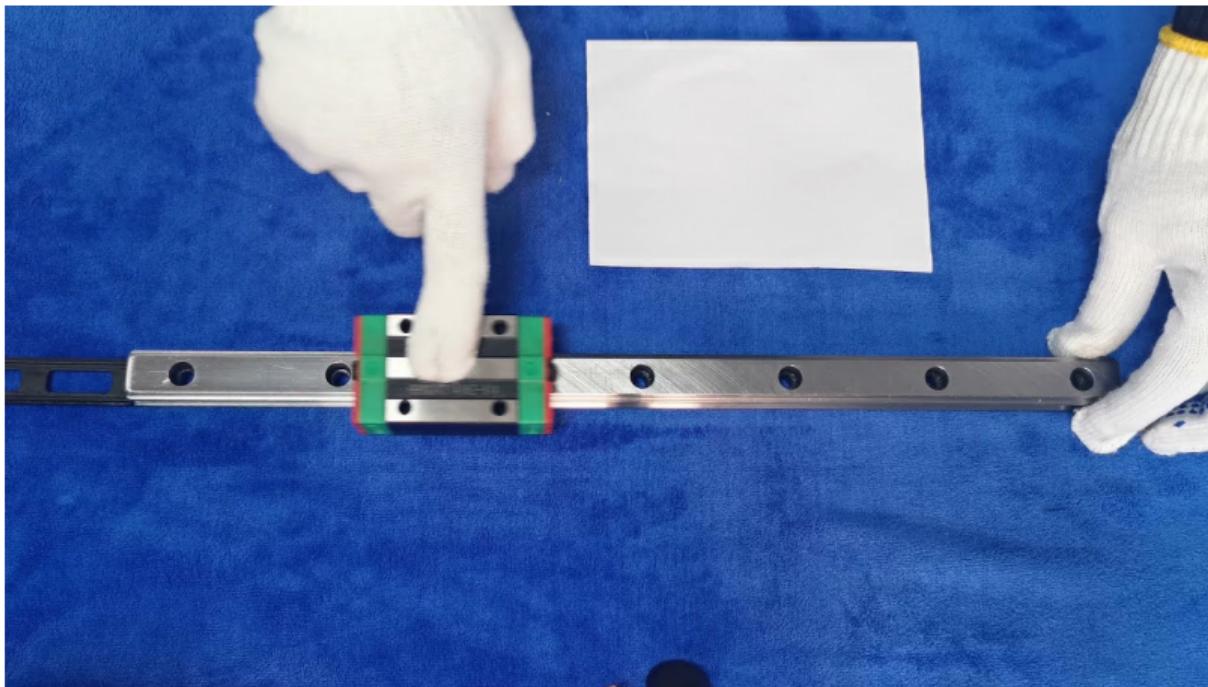
Video





Linear Guideway

Video





Types of bearings



Ball Bearing



Roller Bearing



Plain Bearing



Flexure Bearing



Needle Bearing



Linear Bearing



Fluid Bearing



Magnet Bearing



Taper Bearing

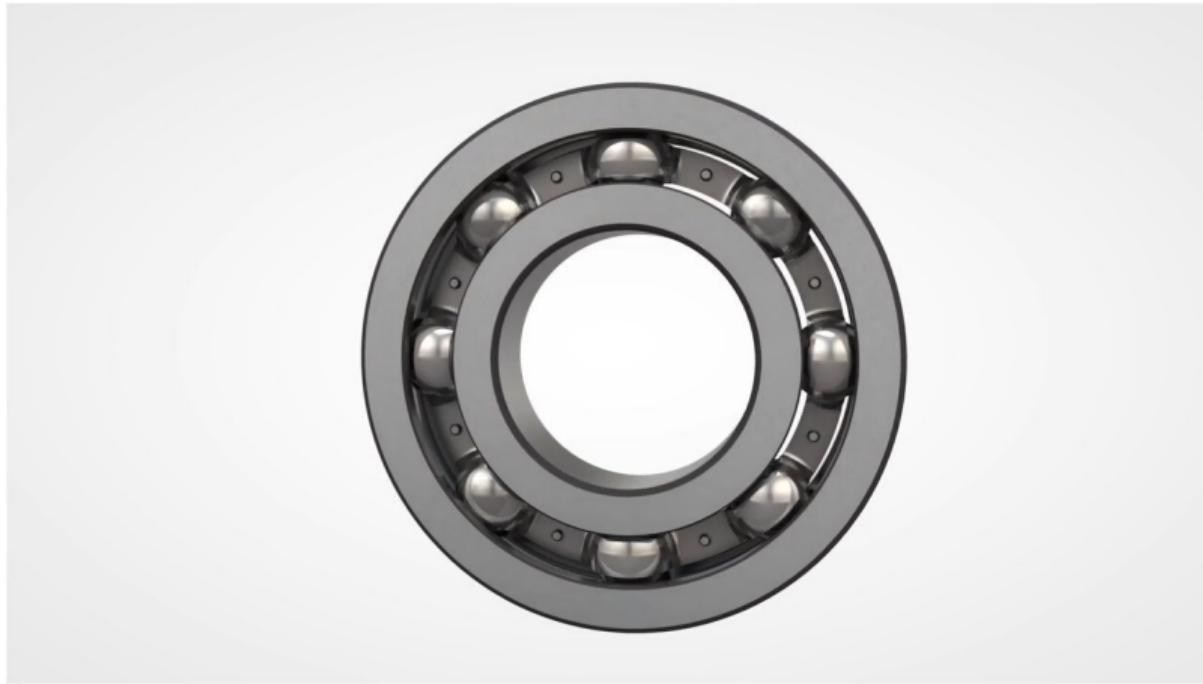


Cylinder Bearing



Mounting and dismounting bearings

Video





Hot dismantling bearings

Video





Mounting and dismounting bearings

Depending on the bearing type and size, mechanical (cold), thermal (hot) and hydraulic methods are used for mounting.

BEARING MOUNTING METHODS OVERVIEW

	Mechanical (cold) mounting	Hot mounting	Hydraulic mounting / oil injection
Bearing size	Small, medium	Small, medium, large	Small, medium, large
Seat type	Cylindrical, tapered, adapter sleeve, withdrawal sleeve	Cylindrical	Tapered, adapter sleeve, withdrawal sleeve
Tools used	Fitting tool, hook spanner, impact spanner	Hot plate induction heater, hot oil bath	Hydraulic nut and pump, drive up method, oil injection method

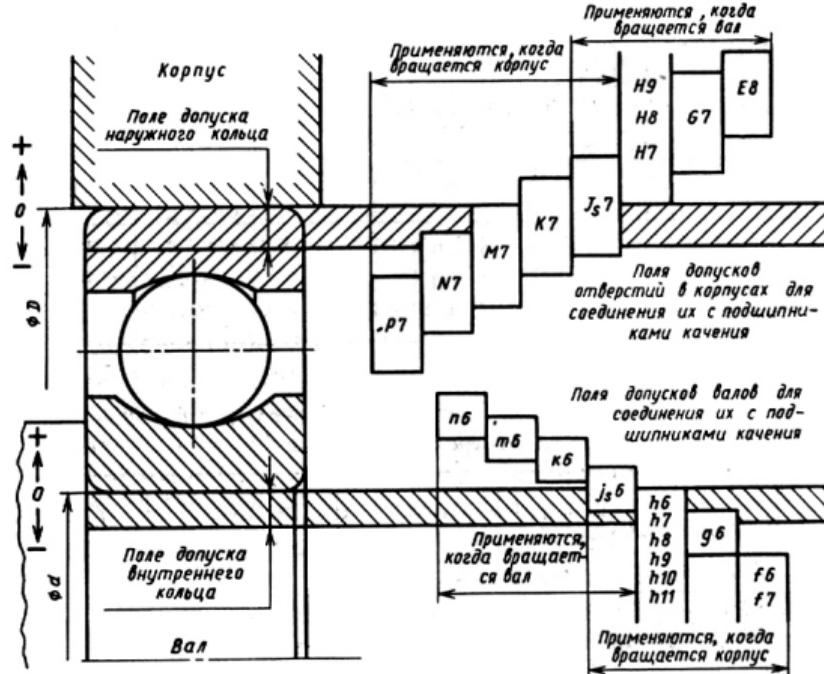
Quality of press-fit surfaces. Rule for selecting tolerances

Video





Tolerances for mounting (GOST)





Mounting of roller bearings on shafts

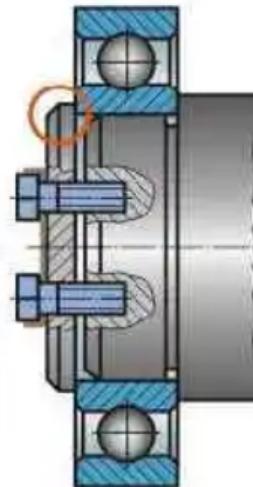
Посадка
с натягом
до упора
в заплечик



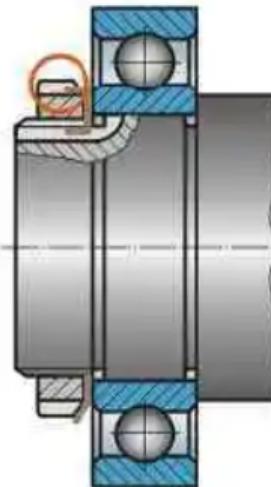
Пружинным
кольцом



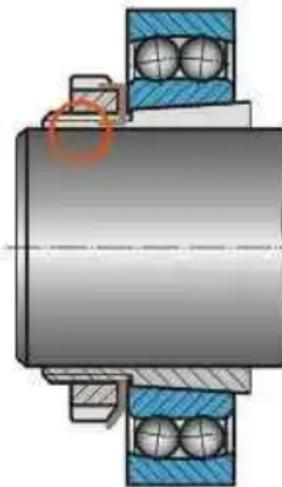
Торцовой
шайбой



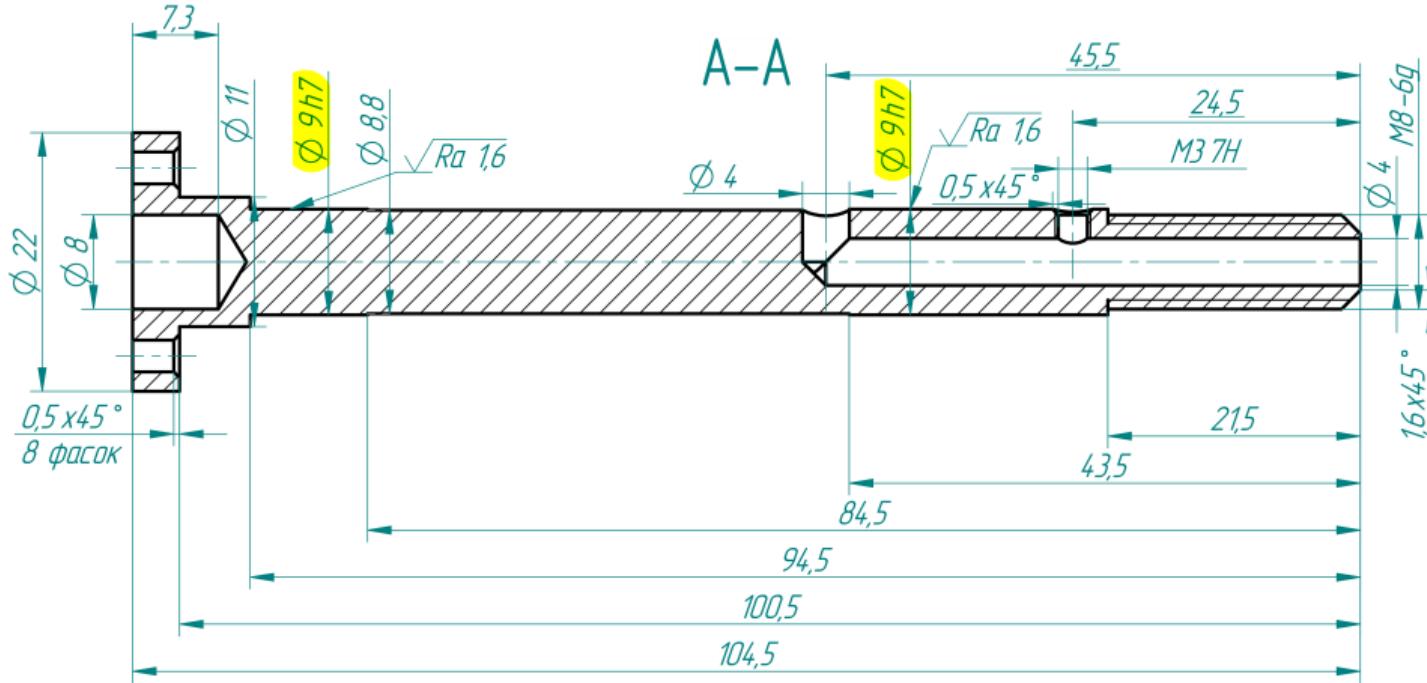
Гайкой



Конической
разрезной втулкой

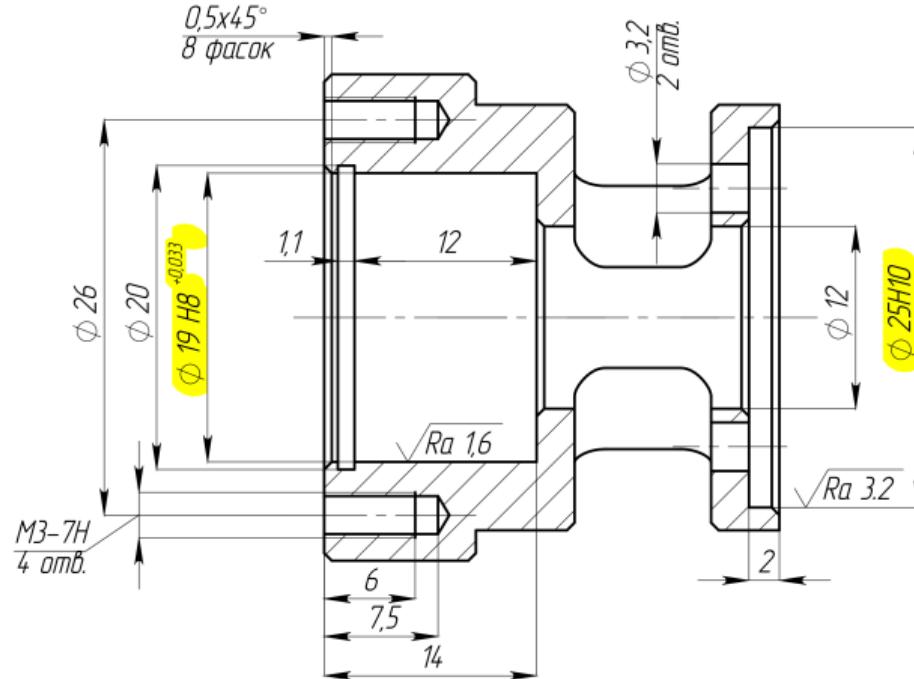


Case Study: HW_CAD_DET2





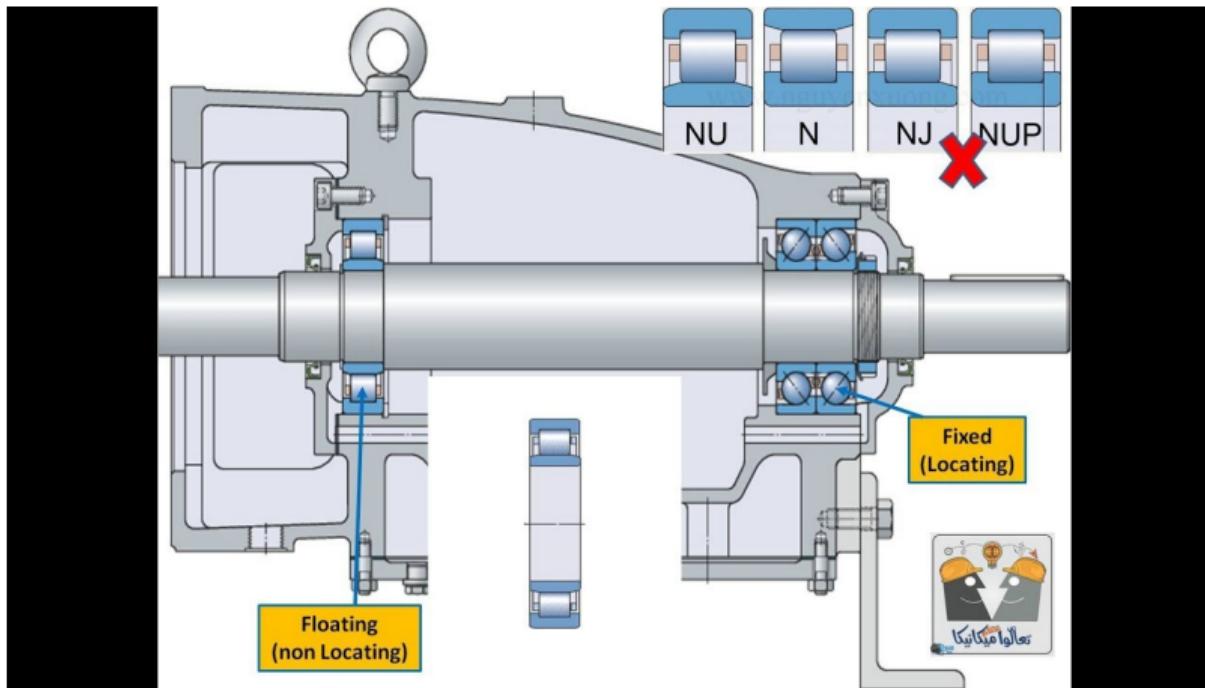
Case Study: Eurobot shaft flange





Locating and floating bearings

Video





Pillow Block

Video





Bearings

Reference material

- Site for ordering bearings in Russia
- Bearings (video)
- Linear Guideway Hiwin (video)
- Rolling bearings (video, rus)
- Plain bearings (video, rus)
- Bearing mounting guide
- All info about how to design bearing housing (rus) (recommended)



Reference material

1. List of Basic Mechanical Parts (video)
2. Mott R. L., Vavrek E. M., Wang J. Machine Elements in Mechanical Design, Ed. — 2011
3. Avallone E. A., Baumeister III T., Sadegh A. Marks' standard handbook for mechanical engineers. — McGraw-Hill Education, 2007.
4. Budynas R. G. et al. Shigley's mechanical engineering design. — New York : McGraw-Hill, 2011.
5. A lot of engineering books in english

Deserve “A” grade!

– Oleg Bulichev

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↗ @Lupasic

🚪 Room 105 (Underground robotics lab)