Lab4Schools

Lab Activity “Chess”

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IPSIA - Istituto Professionale Statale dell'Industria e l'Artigianato
L.B. ALBERTI

Our school was born in 1882, with the aim to provide a good training course to the workers.

In the last few years there are three courses: mechatronics, optics and optometry and health and social care.

In our school, the different laboratories play a key role because nowadays there is an increasing digitalization of manufacturing processes so the courses are tailored to industry needs, when our students leave finish the school they are ready to launch their career in whatever industry they train in.

Here in after there are some lab activities that our students showed to their foreign colleagues:

1) Chess

The aim is to let students able to program a CNC and make some chess pieces.

To be able to program the CNC the students had to study the following topics:

- **Materials**: one of the most important fields of mechanical engineering deals with materials, their properties, and their main applications. This is the object of study of materials science. The materials most widely used in mechanical engineering are

metals, plastics, ceramics, composites, and cutting materials. In the past few years, however, increasingly advanced materials have opened the door for improved and more reliable technology and products. Metals include such elements as gold, silver, copper, iron, lead and tin. They are characteristically lustrous,1 ductile, and fusible and are good conductors of heat and electricity. Metals can be divided into two broad categories: ferrous and non-ferrous. Ferrous metals contain iron in significant quantities. All the alloys based on iron, such as steel and cast iron, are ferrous metals. On the contrary, non-ferrous metals do not contain iron at all.

To make chess pieces the students used non-ferrous metals such as aluminium, and copper.

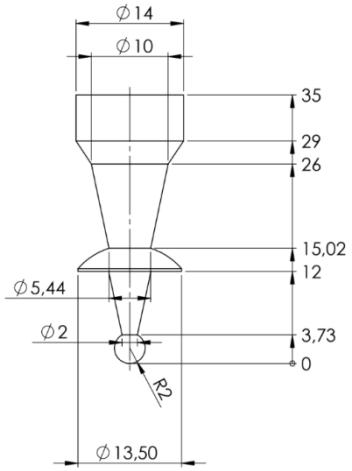
Aluminium is the third common element in the Earth's crust, this light grey metal is mainly recovered from bauxite ore by electrolysis. It is light, strong and resistant to corrosion. It is a very good conductor of electricity and heat and it machines well. It can be extruded, that is forced through a pattern to shape it. It is not readily tarnished and it has a relatively low melting point. It has a wide range of uses: cans, ladders, tubing, aircraft and kitchen ware. It can also be mixed with magnesium, silicon, iron, nickel and zinc to form stronger alloys. Moreover, it can be easily recycled helping to preserve the environment.

Copper is a malleable and ductile reddish brown metal which has a good workability and resistance against corrosion, copper does not require any maintenance, which make it very economical. Thanks its ductility it can be easily beaten into shape. It is mostly used as a base for alloys and as an electrical conductor, Furthermore, being a natural material, it is environmentally friendly.

- **Machining operation**: every operation in the manufacturing process is performed by a machine tool, a power-driven machine that perform a machining

operation. Machining is a manufacturing process in which a cutting tool is used to remove excess material from a workpiece. Machining can be used to create any regular geometric shape, such as flat or curved surfaces, round or special formed holes, and cylinders. It is also used for shaping or finishing metal parts. Most machine tools operate by removing material from the workpiece. In order to withstand the great heat that these operations generate, the materials used in machine tools must be extremely hard and durable. This is the reason why their working surfaces are made of such materials as high-speed steels, sintered carbides, and diamonds. In order to dissipate the heat, the area of contact between their working surface and the workpiece is usually lubricated with a fluid that may also improve the finish of the workpiece's surface. Automation plays a key role in the most advanced types of machine tools. Modern machine tools are often numerically (NC) or computer numerically controlled (CNC). CNC refers to the idea of controlling machine tools programmatically via computer. It allowed for enormous increases in productivity for machine tools because the machines could be run automatically without requiring the constant attention of their operator.

- **CAD**: generally, designers begin by sketching their design, then use CAD to draw the design digitally. With some CAD software, you can import a photo of your sketch and begin drawing over the sketch with the digital design tools. So, the students have to learn how to use it for the design process. Before CAD we used large sheets of paper on drawing boards, big rulers and geometry equipment, different grades of pencils. It is useful because the students quickly develop and visualize designs, edit designs quickly to improve them, personalize designs easily, used in a variety of types of design.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R2
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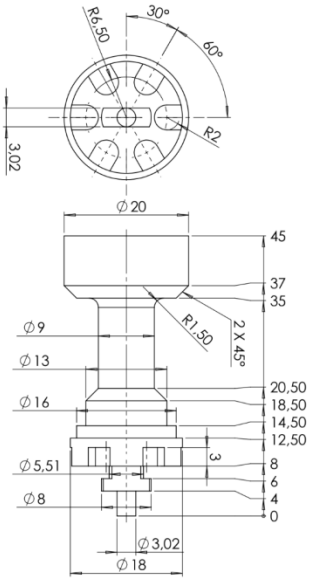
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8
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∅18