

Mehatronika

Avtomatizacija in robotika



Simona Vincelj



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POVZETEK

Gradivo opisuje uvajanje avtomatizacije in robotike v industrijo in vsakdanje življenje. Predstavljeno je strokovno besedišče: deli avtomatiziranih naprav, različni postopki dela, vrste industrijskih robotov in njihova uporaba. V slovnichem delu so predstavljeni osnovni časi v trpniku ter modalni glagoli za napovedovanje in predvidevanje dogodkov v prihodnosti (may, might, could; will). Gradivo opisuje tudi tehnologijo prihodnosti in dopušča uporabo domišljije.

Ključne besede: automation, CNC machine tools, CAD / CAM, computers, car industry, industrial robots, robotics, technology, android, pressing, forging, welding, E-skin.

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CIP –



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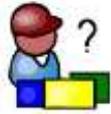
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AVTOMATIZACIJA



Preberite besedilo in spoznajte, kaj pomeni beseda avtomatizacija, kakšen je bil njen razvoj in kakšna je razlika med NC in CNC napravami.



Introduction (uvod)

Automation includes various types of automated devices, from computers to robots. It started in the late 40s with the use of *automatic* devices and controls in product manufacturing. A machine tool is automatic when it is capable of producing parts without an operator's assistance in loading parts, starting the machine and unloading parts. Actually, some automatic machine tools are only semi-automatic because they need an operator even if most operations are automatic.



Numerically controlled (NC) machine tools were the first examples of machine tools that used varying degrees of automatic and semi-automatic controls. Nowadays computers are widely used in technology for several applications that include: controlling machines, controlling robots designing articles, producing drawings, simulating, etc.

Two important developments in automation have been CNC machine tools and CAD/CAM.

Slika 1: A computerized machine tool. Vir: <http://mechatronic-nusantara.com> (12.12.2011)



How does it work?

First steps

The earliest forms of NC (numerical control) were developed in the 50s and were being used to replace the hand wheels. Early systems were limited by *the lack of* detailed analysis for the geometrical drawings of the components to be manufactured. Later, when computers were developed, that problem was *overcome*. The significant development *occurred* in the early 60s with a new system (Sketchpad) which made it possible to draw designs on a *cathode-ray tube* using a light-pen and a keyboard. Another step occurred when this system was connected to a computer.

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CNC machines

In the 70s, CNC systems were developed *to enable* machine tools to be readily adapted to different jobs, by altering the control program and software.

CNC machine tools are easier to operate than NCs. They are cheaper *to maintain* and more *accurate* and their programming is simpler. They can be used with a wide range of machine tools such as *lathes* or milling machines.

Many are equipped with graphic displays. Some simulate tool movements, while others produce three-dimensional views of components.

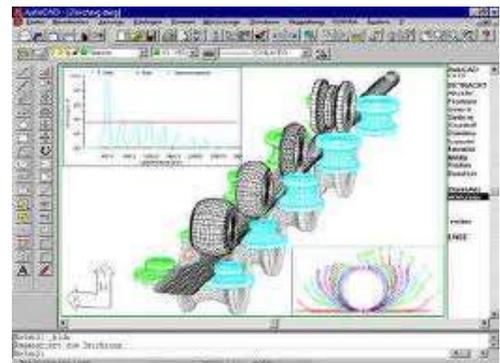
CNC machines are controlled by a set of instructions based on numbers. You write a computer program and this controls a machine as it makes the parts. Once a computer program has been written, you can make as many identical parts as you wish. Any *errors* are easily detected and can be corrected immediately, avoiding waste of both time and material.

CAD/CAM

CAD/CAM *stand for* Computer-Aided-Design and Computer-Aided-Manufacture, and that is what they are: aids to design! Instead of designing a part on paper and then writing the program to manufacture it, the two stages can be done directly on the computer using CAD/CAM software. It is often used as a quick method of producing a CNC program to machine a *component* that has already been designed.

CAD and CAM are already being used to great advantage in many industrial plants such as the automobile and aerospace industries to cut production times and improve quality product and these techniques are increasingly being adopted in many other areas of industry and production.

Slika 2: CAD



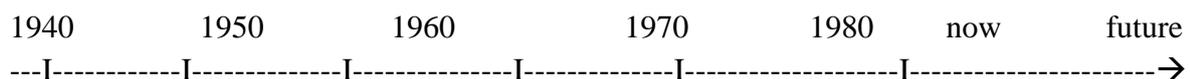
Vir: <http://www.marvit.us/cadcam.html>

(12.12.2011)



VAJE

1 Prikažite razvoj avtomatizacije na časovni črti



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2 Odgovorite na vprašanja.

- 1 What is CNC?
- 2 How does it work?
- 3 What do you think its future in industry could be?
- 4 What is it used for?

3 Besede, ki so v besedilu napisane *ležeče*, povežite z njihovimi definicijami

- 1 to keep in good working condition - _____
- 2 computer program - _____
- 3 a part of something - _____
- 4 the state of needing something that is absent or unavailable - _____
- 5 operating with minimal human intervention - _____
- 6 mean - _____
- 7 wrong actions, mistakes - _____
- 8 precise - _____
- 9 a machine for shaping articles of wood, metal or other materials - _____
- 10 to give ability, to empower - _____
- 11 a beam of electronics emitted by the cathode of an electrical discharge tube - _____
- 12 happened - _____

4 Ugotovite pomen besed ter jih prevedite.

angleško

slovensko

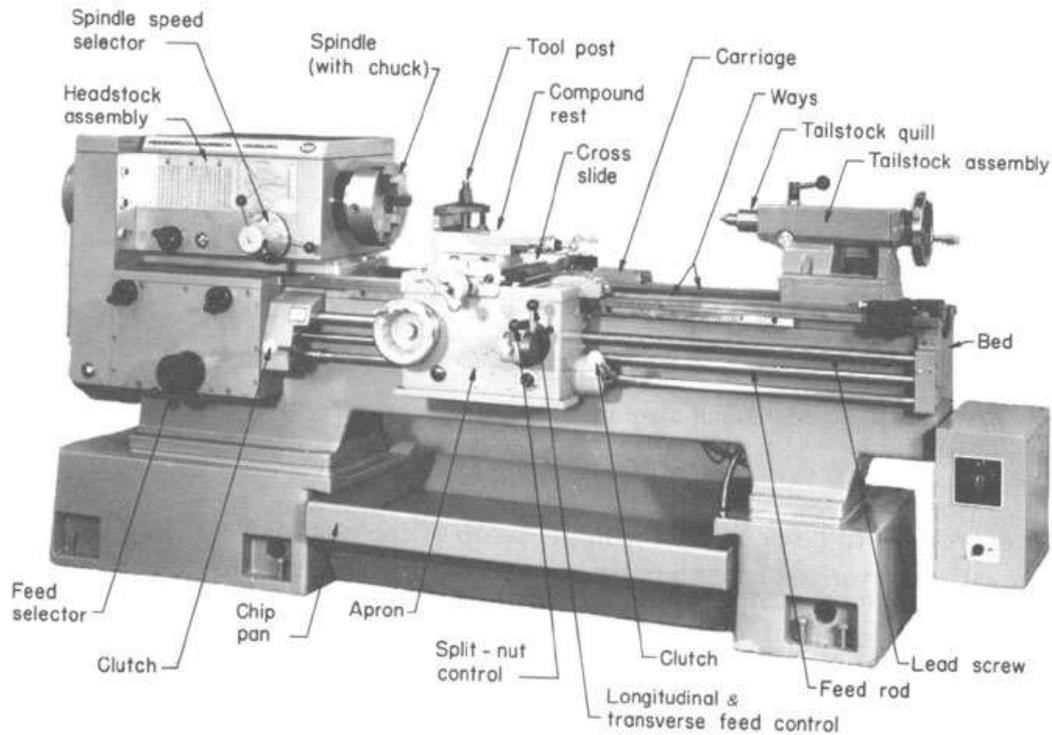
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



Pomembno je, da poznamo sestavne dele naprave, s katero delamo.



Diagram avtomatizirane stružnice



Slika 3 : Avtomatizirana stružnica. Vir: http://www.americanmachinetools.com/lathe_diagram.htm (12.12.2011)

Explanation of the standard components of most lathes:

- bed: usually made of cast iron. Provides a heavy rigid frame on which all the main components are mounted.
- ways: inner and outer guide rails that are precision machined parallel to assure accuracy of movement.
- headstock: mounted in a fixed position on the inner ways, usually at the left end. Using a chuck, it rotates the work.
- gearbox: inside the headstock, providing multiple speeds with a geometric ratio by moving levers.
- spindle: hole through the headstock to which bar stock can be fed, which allows shafts that are up to 2 times the length between lathe centres to be worked on one end at a time.
- chuck: 3-jaw (self centering) or 4-jaw (independent) to clamp part being machined.
- chuck: allows the mounting of difficult work pieces that are not round, square or triangular.

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- tailstock: fits on the inner ways of the bed and can slide towards any position the headstock to fit the length of the work piece. An optional taper turning attachment would be mounted to it.
- tailstock quill: has a morse taper to hold a lathe centre, drill bit or other tool.
- carriage: moves on the outer ways. Used for mounting and moving most the cutting tools.
- cross slide: mounted on the traverse slide of the carriage, and uses a hand wheel to feed tools into the work piece.
- tool post: to mount tool holders in which the cutting bits are clamped.
- compound rest: mounted to the cross slide, it pivots around the tool post.
- apron: attached to the front of the carriage, it has the mechanism and controls for moving the carriage and cross slide.
- feed rod: has a keyway, with two reversing pinion gears, either of which can be meshed with the mating bevel gear to forward or reverse the carriage using a clutch.
- lead screw: for cutting threads.
- split nut: when closed around the lead screw, the carriage is driven along by direct drive without using a clutch.
- quick change gearbox: controls the movement of the carriage using levers.
- steady rest: clamped to the lathe ways, it uses adjustable fingers to contact the work piece and align it. Can be used in place of tailstock or in the middle to support long or unstable parts being machined.
- follow rest: bolted to the lathe carriage, it uses adjustable fingers to bear against the work piece opposite the cutting tool to prevent deflection.



VAJE

V slovarju poiščite pomen besed:

- bed: _____
- way: _____
- headstock: _____
- gearbox: _____
- spindle: _____
- chuck: _____
- chuck: _____
- tailstock: _____
- tailstock quill: _____
- carriage: _____
- cross slide: _____
- tool post: _____

Učno gradivo je nastalo v okviru projekta Munus 2. Njegovo izdajo je omogočilo sofinanciranje Evropskega socialnega sklada Evropske unije in Ministrstva za šolstvo in šport.

compound rest: _____
 apron: _____
 feed rod: _____
 lead screw: _____
 split nut: _____
 quick change gearbox: _____
 steady rest: _____
 follow rest: _____



Grammar spot: Passive (trpnik)

Eden od načinov opisovanja postopka je tvornik ali aktiv.

A program controls a machine. (present simple)

Vendar v angleščini za opisovanje postopka ponavadi uporabimo trpnik ali passive.

A machine is controlled by a program. (present simple passive)

Form:

to be + past participle

Če želimo spremeniti čas v trpniku, spremenimo čas glagola biti:

tense	to be	Example
Present Simple	am, is, are	A machine is controlled by a program.
Present Continuous	am/is/are being	A machine is being controlled by a program.
Past Simple	was, were	A machine was controlled by a program.
Past Continuous	was, were	A machine was being controlled by a program.
Present Perfect	has/have been	A machine has been controlled by a program.
Will Future	will be	

Učno gradivo je nastalo v okviru projekta Munus 2. Njegovo izdajo je omogočilo sofinanciranje Evropskega socialnega sklada Evropske unije in Ministrstva za šolstvo in šport.



VAJE – passive (TRPNIK)

1 V besedilu na strani 4 in 5 poiščite primere trpnika v naslednjih časih:

tense	example
Present Simple	
Present Continuous	
Past Simple	
Past Continuous	
Present Perfect	
Will Future	

2 So spodnji stavki napisani v aktivni ali v pasivni obliki?

- They listen to music.
- She is reading an e-mail.
- These cars are produced in Japan.
- Alan teaches Geography.
- German is spoken in Austria.
- Lots of houses were destroyed by the earthquake.
- Henry Ford invented the assembly line
- The bus driver was hurt.
- You should open your workbooks.
- Houses have been built.



Passive:

to be + past participle

3 Pretvorite stavke iz aktivne v pasivno obliko

- John collects money.
Money _____
- Anna opened the window. –
The window _____
- We have done our homework. –
Our homework _____
- I will ask a question. –

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e. He can cut out the picture.

f. The sheep ate a lot. –

g. We do not clean our rooms. –

h. William will not repair the car. –

i. Did Sue draw this circle? –

j. Could you feed the dog? –

**4 Dopolnite stavke s pravilnimi oblikami glagolov v aktivni ali pasivni obliki.
Uporabite Present Simple.**

a) He (sell) _____ cars.

b) The blue car (sell) _____.

c) In summer, more ice-cream (eat) _____ than in winter.

d) She (call) _____ her grandparents every Friday.

e) The letters (type) _____.

f) He (take) _____ his medicine every day.

g) Jane (take / not) _____ to school by her father.

h) We (go) _____ to school by bus.

i) She (work / not) _____ for a bank.

j) Milk (keep) _____ in the refrigerator.

5 Dopolnite stavke s pravilnimi oblikami glagolov v pasivni obliki.

a) The bridge _____ (blow off) yesterday.

b) This novel _____ (write) by Hemingway.

c) Flies _____ (catch) by spiders.

d) He _____ (offer) a new job last week.

e) All the trees _____ (cut) down yesterday.

f) We _____ (tell) to go home now.

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- g) Their purse _____ (steal) yesterday night in the disco.
 h) He _____ (throw) out of the bar a week ago.
 i) The old theatre _____ (reopen) last Friday.
 j) Mice _____ (catch) by cats.
 k) Look at that man! I think we _____ (follow)!
 l) Don't leave me! I _____ (lose) without you.

6 Vstavite pravilno obliko glagola

In Paxham yesterday a shop assistant _____ (force) to hand over £ 500 to a man with a knife. The man _____ (wear) a black mask and he _____ (escape) in a car which _____ (steal) earlier that day. The car _____ (find) later in a car park. The police _____ (arrest) a woman in connection with the robbery but she _____ (not/question) yet. They _____ (hope) that she will _____ (can give) them some information about the man. She _____ (release) tomorrow.



PONOVIMO



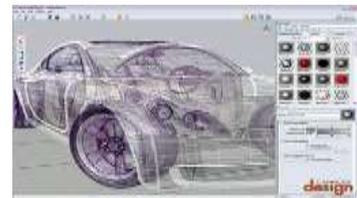
Uporaba računalnikov v avtomobilski industriji

1 Kaj pomenijo izrazi 1-4? Preberite besedilo in preverite svoje odgovore.

1 CAD 2 CAM 3 CIM 4 CNC

All products begin with an idea. In the past, car designers worked first on paper. At a later stage models were made in wood or fibreglass. Now everything is done using CAD (Computer –aided design) programs.

These programs allow designers to work in two or three dimensions (2-D or 3-D) but most new



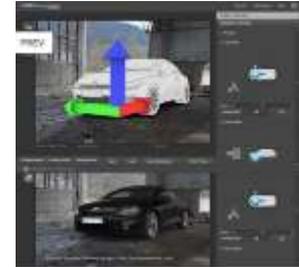
Slika 4: CAD

Vir: <http://www.sciencephoto.com> (15.1.2012)

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designs are created using a solid modelling program which allows a model to be viewed from any angle. It can also be viewed by engineers executives anywhere in the world.

Crash conditions can be simulated to test the safety features of the car before a single component of a prototype is produced. Assembly can be simulated to work out the best way of building a car. This saves time and money. For components such as engine parts, the file is imported into a CAM (Computer-aided manufacturing) program. Here all machining operations are planned.



Slika 5: CAD

Vir: <http://www.sciencephoto.com> (15.1.2012)



Slika 6: Roboti v industriji

Vir: <http://www.drive.com.au>
(15.1.2012)

The file is then sent to a post-processor which converts the data into a set of instructions that can be read by Computer numerical controlled (CNC) machine tools. These instructions are fed to a CNC controlled which controls the machine tools which shape the finished product.

In complete Computer-integrated manufacturing (CIM), computers control the assembly line and monitor the supply of materials, ordering new supplies when needed. They can calculate when tools need to be replaced.

On the assembly line, computer-controlled robots are used for tasks such as welding and painting. Robots with sensors check the finished vehicle for defects.

2 Dopolnite stolpec B

A How was it done in the past?	B How is it done now?
1 design produced on paper	
2 dimensions calculated by measuring	
3 models made by hand	
4 real car crash-tested	
5 cars inspected by people	
6 supplies ordered by staff	
7 welding done by hand	
8 painting done by workers	

3 Trditve iz stolpca A spremenite v stavke.

Primer: 1 Designs were produced on paper.

2 _____

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- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____

4 Povežite oba dela trditev, preteklost in sedanost, v en stavek.

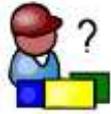
Primer: Designs were produced on paper but now they are produced by CAD programs.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____

5 Stavkom določite čas in način.

	tense	active/passive
Mandy has played the piano.	present perfect	active
These cars are produced in Japan.	present simple	passive
She is reading an e-mail.		
They listen to music.		
Alan teaches Geography.		
German is spoken in Austria.		
Lots of houses were destroyed by the earthquake.		
Henry Ford invented the assembly line.		
The bus driver was hurt.		
You should open your workbooks.		

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Vpliv novih tehnologij

1 Preberite spodnje besedilo

The introduction of automation in the manufacturing sector led to a massive reduction in the size of the workforce required for the production process. In addition, the use of new technologies such as CNC and robotics to carry out low-skilled, repetitive tasks meant that assembly lines no longer needed manual labour but a workforce of support technicians whose job is to ensure that the computers and robots perform assembly functions at the optimum rate and efficiency. This has led to the employment of an increasing number of women in the electronics industry and has created job opportunities for the disabled.



Slika 7: Robotska roka

Vir: <http://www.dericksleasing.com>

(15.1.2012)

Furthermore, manufacturing companies now require a minimum level of education even for assembly line work which was previously regarded as suitable for unqualified, unskilled labour. Advances in technology require more and grater skills and knowledge.

It is also necessary for workers to become multiskilled so that the can move between operations. Most large companies are now promoting adaptability and flexibility within the workforce trough lifelong learning. However, while automation has meant a reduced workforce in the manufacturing engineering sector it has also meant an increase in that of the microtechnology industry which supplies the needs of automatic manufacturing activities.

2 V besedilu poiščite prednosti (pros) in slabosti (cons) nove tehnologije.

pros	cons

3 PAIR WORK. S sošolcem predebatirajte prednosti in slabosti NC naprav. Pomagajte si s spodnjo razpredelnico.

ADVANTAGES	DISADVANTAGES
<p>FLEXIBILITY – NC machines can be quickly reprogrammed to produce different items.</p> <p>REPEARIBILITY – NC machines can make high numbers of parts exactly the same. No worker with a manual machine tool can do that.</p> <p>REDUCTION OF COSTS – spare parts are no longer stored in a warehouse. Investment is reduced, capital is not tied up. Change in design can be made easily.</p> <p>LOWER SKILLS – NC operators simply load/download the workpiece, push the buttons to start or stop. They are easier to find and train. Salaries are not high.</p>	<p>LARGE INVESTMENT – NC equipment has high initial costs and machinery must be kept busy to pay off. Small firms can not afford the investment.</p> <p>SKILL PROGRAMMERS REQUIRED- NC systems need trained personnel responsible for programming commands, setting up and running production. They are not easy to find. Salaries are high.</p> <p>HIGH MAINTAINANCE COSTS – NC machines can be very complex and need special and continuous maintenance. Maintenance personnel must be experts on both mechanical and electrical systems: a difficult combination of skills to find. Salaries are high.</p>



PONOVIMO

1 So spodnje trditve pravilne (T=true) ali napačne (F=false)? Popravite napačne.

- CNC machines need less control hardware than NC equipment.
.....
- NC machines are very flexible ; they can be readily adapted to different jobs.
.....
- A wide variety of machine tools can be equipped with CNC systems.
.....

d. NC machines are easy to maintain.
.....

e. Numerical control deals with few and specific machining operations
.....

2 PAIR WORK. S sošolcem predebatirajte prednosti in slabosti avtomatizacije v industriji, njen vpliv na razvoj in na človeka. Svoje stališče podkrepite s primeri. Spodaj imate nekaj uporabnih besednih zvez, s katerimi si lahko pomagate:

Building up an argument

first of all / to start with
in addition to...
what is more...
on top of that...

Indicating facts

...the fact is that...
I couldn't agree more...
That's just what I think...
...as a matter of fact...

Expressing personal opinions

...in my opinion...
... for my part...
Personally,

Expressing disagreement

I don't agree (with)...
I wouldn't say that exactly
I disagree with...

Reaching conclusion

In short...
In this case...
In conclusion...
To sum up..



PRIHODNOST TEHNOLOGIJE

Odgovorite na vprašanja

1. What does a word “robot” make you think about?
2. What is a robot? Does it have to look like a human?
3. Why do engineers design and build robots?
4. Where do the ideas for how robots work come from?
5. Can you think of a situation in which a robot would be necessary or at least helpful?
6. Does someone you know have a robotic co-worker?
7. Would you like to have a robot able to help you do your homework?



Kaj je robot? - What is a robot?

The term comes from a Czech word, *robota*, meaning "forced labor." The word *robot* first appeared in a 1920 play by Czech writer Karel Capek, R.U.R.: Rossum's Universal Robots. In the play, the robots eventually overthrow their human creators.

What makes a machine a robot?

A robot is a machine designed to execute one or more tasks repeatedly, with speed and precision. The Robot Institute of America (RIA) defines a robot in this way:

“A robot is a programmable multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks”.

Robotics is related to cybernetics – that is the use of computers and automatic machinery to control complex mechanical operations. The robots in the movies, such as I, Robot and the Terminator are portrayed as fantastic,



Slika 8: Robot

Vir: <http://vhrzica.bravehost.com> (15.1.2012)



Slika 9: NASA exploring robot

Vir: <http://www.nasa.gov> (15.1.2012)

intelligent, even dangerous form of artificial life. However, today we find most robots working for people in factories, warehouses in the form of robotic arm. They handle tasks that are difficult, dangerous or boring for human beings.

In the future robots may show up in our schools, our homes, even our bodies. Each new use brings new hope and possibilities, but also potential dangers and risks.

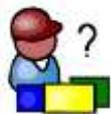
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VAJE

Povežite dele stavkov:

a) Robots	1 will find their way into schools, hospitals and houses.
b) The robots in movies	2 advantages but also risks.
c) In the future robots	3 they are fast, precise and reliable.
d) Robots are used because	4 are designed for heavy and repetitive work.
e) The robotic arm	5 is mostly used in factories.
f) New uses of robots will have	6 Are intelligent form of artificial life.



Ali ste vedeli?

Asimov's Three Laws of Robotics

The Three Laws of Robotics are a set of rules devised by the science fiction author Isaac Asimov. The rules are introduced in his 1942 short story "Runaround", although they were foreshadowed in a few earlier stories. The Three Laws are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders conflict would with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.



Slika 10: Isaac Asimov

Vir: (<http://www.fantasticfiction.co.uk>)

(22.1.2012)

Asimov developed the Three Laws because he was tired of the science-fiction stories of 1920s and 1930s in which robots turned on their creators and became dangerous monsters.

The Laws are incorporated into almost all of the positronic robots appearing in his fiction, and cannot be bypassed, being intended as a safety feature.

The original laws have been altered and elaborated on by Asimov and other authors. Asimov himself made slight modifications to the first three to further develop how robots would interact with humans and each other; he also added a fourth, or "Zeroth" law, to precede the others:

0. A robot may not harm humanity, or, by inaction, allow humanity to come to harm.

Učno gradivo je nastalo v okviru projekta Munus 2. Njegovo izdajo je omogočilo sofinanciranje Evropskega socialnega sklada Evropske unije in Ministrstva za šolstvo in šport.

Have you seen a film *I, Robot*?

I, Robot is a 2004 sci-fi action movie starring Will Smith. It bears no direct connection to Isaac Asimov's book of the same name. The story follows Del Spooner (Smith), a homicide detective in 2035 Chicago. By 2035, robots have permeated every level of human society, and U.S. Robotics is on the verge of the largest robotic distribution in history. Spooner is very much anti-robot (and to some degree technology in general), while everyone is certain that robots are safe and reliable.



Slika 11: Prizor iz filma *I, Robot*

Vir: <http://www.zone-sf.com> (22.1.2012)

He has to investigate the murder of dr. Lanning, who worked at U.S. Robotics. A robot named Sonny seems to be implicated in his death, even though that would mean the robot had violated the Laws of Robotics, which is apparently impossible. If robots can break those laws, there's nothing to stop them from taking over the world.



PONOVIMO

Industrijski roboti – Industrial Robots

There are as many different types of robots as there are tasks for them to perform. Industrial robots perform several tasks, including:

- Transportation of materials, pressing, forging and welding, with robots lifting workpieces from the hot press and placing them on the conveyor belt, or preparing the molten metal to be poured into moulds and trimming the finished products.
- Mechanical operations, which include both transportation of workpieces and feeding of machine tools.
- Assembly line operations, with robots used for the assembly of mechanical apparatus and electronic devices.
- Painting, a sector of automobile industry, as they can work in the closed environment and at low temperatures.



Slika 12: Industrijski roboti

Vir: <http://english.hhi.co.kr> (28.1.2012)

A robot can be controlled by a human operator, sometimes from a great distance. But most robots are controlled by computer, and fall into either of two categories: autonomous robots and insect robots. An autonomous robot acts as a stand-alone system, complete with its own computer (called the controller).

Insect robots work in fleets ranging in number from a few to thousands, with all fleet members under the supervision of a single controller. The term insect arises from the similarity of the system to a colony of insects, where the individuals are simple but the fleet as a whole can be sophisticated.

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Robots are sometimes grouped according to the time frame in which they were first widely used. There are three main types of robots working in industry today:

- First-generation robots date from the 1970s and consist of stationary, nonprogrammable, electromechanical devices without sensors.
- Second-generation robots were developed in the 1980s and can contain sensors and programmable controllers.
- Third-generation robots were developed between approximately 1990 and the present. These machines can be stationary or mobile, autonomous or insect type, with sophisticated programming, speech recognition and/or synthesis, and other advanced features.

Fourth-generation robots are in the research-and-development phase, and include features such as artificial intelligence, self-replication, self assembly, and nanoscale size (physical dimensions on the order of nanometers, or units of 10^{-9} meter).

Some advanced robots are called androids because of their superficial resemblance to human beings. Androids are mobile, usually moving around on wheels or a track drive (robots legs are unstable and difficult to engineer). The android is not necessarily the end point of robot evolution. Some of the most esoteric and powerful robots do not look or behave anything like humans. The ultimate in robotic intelligence and sophistication might take on forms yet to be imagined.



Slika 13: Asimov Honda

Vir: <http://www.diseno-art.com>.
(28.1.2012)

1 Odgovorite na vprašanja.

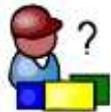
1. What is a robot?
2. How can it be controlled?
3. Write down the characteristics of robots:

autonomous	
insect	
first-generation	
second-generation	
third-generation	
fourth-generation	
android	

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4 Povežite spodnje definicije z ustreznimi besedami.

a) welding	1 to crush into small fragments
b) pressing	2 shaping metal by heating and hammering
c) forging	3 the act of piercing with a drill
d) painting	4 cutting down to the desired size or shape
e) trimming	5 to act upon with force, as weight
f) drilling	6 fastening two pieces of material together by softening with heat and applying pressure
g) grinding	7 to cover with paint



Robot skin

Robots are very good at doing the same task in the same place over and over again. In factories and nuclear power stations more than a million robots behave in this way every day. For robots to work with people, they need to be more like humans. They need to be able to move like humans and adapt to new places. They also need to be more sensitive to touch and



Slika 14: Robotska koža . Vir: <http://www.robaid.com> (28.1.2012)

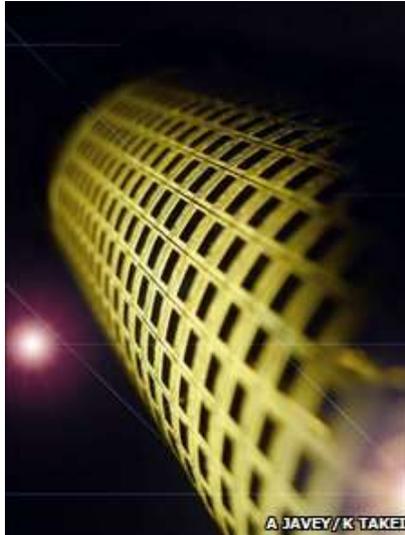
temperature. In humans it is skin which provides important information on pressure and heat.

The most useful type of skin, needed by both conventional robots as well as androids, is skin that can sense the environment. There are a number of approaches for creating skins with sensors. The Someya Lab at the University of Tokyo is researching methods of manufacturing flexible skin with

integrated matrix of organic transistors. They've created a prototype robot hand covered in the sensors. Their material can

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be stretched by up to 25% and can function even when wrapped around a cylinder with a 2mm radius. At present the material is not being produced in commercial quantities.



Another approach, taken by researchers at the University of Nebraska, uses metal and semi-conducting nano-particles that self-assemble into a thin-film device that generates electroluminescence in proportion to stress.

The E-skin opens the way for much more sensitive robots. In the future they will be able to grasp different tools and use them as humans do, without hurting anybody or themselves.

Slika 15: Senzorji na robotski koži
 Vir: <http://www.csmonitor.com> (28.1.2012)

1 Odgovorite na vprašanja

- 1 Which features of human skin does robot skin need to copy? Choose from a-d.
 - a. sensitive to touch
 - b. sensitive to heat
 - c. stretchable
 - d. all of these
- 2 What do robots need in order to work with people?
- 3 How does E-skin stretch?
- 4 Why is stretchability important?
- 5 How could E-skin help robots not to damage themselves?
- 6 What two features of E-skin would be important in bathing a baby?



TEHNOLOGIJA PRIHODNOSTI

- 1 **Prihodnost je težko napovedati. Katerih stvari današnjega časa po vašem mnenju znanstveniki pred petdesetimi leti NISO napovedali?**
- 2 **Preberite prvi odstavek in poiščite dve napovedi, ki se nista uresničili? Se spomnite še kakšnega primera?**
- 3 **Kaj lahko napoveste o prihodnosti tehnologije?**
- 4 **Preberite spodnje besedilo.**

“The best way to predict the future is to invent it.”
Alan Kay

Future technology is what scientists and others dream up first, then work hard to make a reality. Future technology includes many different areas from nanotechnology, science and medicine, computers and many other specific areas such as space tourism, future cars, future weapons and many areas of which people have not dreamed yet. The only certainty about future technology, however, is that it is uncertain. It's very risky to predict future development and many people had done it terribly wrong:

“I think there is a world market for maybe five computers,” said the chairman of IBM in 1943. “This ‘telephone’ has too many shortcomings to be seriously considered as a means of communication,” went an 1876 Western Union internal memo.

In 2007, the World Future Society has released an updated and expanded list of its top ten technology forecasts for 2007 and beyond. Here are some of their predictions. You may find some of them surprising

#1: Hydrogen fuel cells will be cost competitive by 2010. By 2012, fuel cell power is expected to cost around \$400 per kilowatt. Fuel cells will power cars and allow each home to have its own non-polluting electricity generator.



Slika 16: Cyborg

Vir <http://www.mindcontrol.se> (28.2.2012)

#2: The era of the Cyborg is at hand.

Researchers in Israel have fashioned a "bio-computer" using the DNA of living cells instead of silicon chips. This development may soon allow a computer to connect directly with a human brain.



Slika 17: Letalo X-43A

Vir: <http://www.astronet.ru> (28.2.2012)

#3: By 2015, New York, Tokyo and Frankfurt may emerge as hubs for high-speed, large-capacity supersonic planes. NASA's X-43A Scramjet recently

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flew at 7,000 mph (nearly ten times the speed of sound). These hypersonic planes will whisk passengers across continents in the time it takes most people to drive to the airport.

#4: Speculation in hydrogen energy stocks could create an investment bubble, as happened with the Internet. When investors see the huge potential of hydrogen energy, the stocks of companies with promising technologies may skyrocket to unsustainable levels.

#5: A snail may save your life. A non-addictive painkiller, one thousand times more potent than morphine, could soon be on the market, thanks to research on conotoxins, the distinct set of chemicals found in tropical cone snails. Future medicines from the snails may help treat



heart disease, depression and spinal cord injuries, among other ailments.

#6: Weapons of mass destruction will be even easier to obtain over the next 15 years. The weapons of the future—genetic engineering and nanotechnology—require neither large facilities nor mass material.

Slika 18: Stožčasti polž

Vir: <http://www.itsnature.org> (28.2.2012)

#7: The convergence of genetic engineering, nanotechnology and robotics will allow humans to change their bodies in profoundly new ways. In the next 15 years, people may be able to rearrange their genes to change their physical features, extend their lifespan, merge their brains with computers and their bodies with robots, among many other remarkable developments.

#8: Robots and smart environments will improve care and independence for the elderly. Intelligent walkers will help seniors get around while sensors on the handlebars monitor their vital signs. Handheld devices will track senior citizens' movements and guide them around town, keeping people mobile and independent.



Slika 19: Ekran na dotik

Vir: <http://www.hitechreview.com>
(28.2.2012)

#9: As you enter your living room, sensors will detect your presence and the walls will start to glow. Talk to the walls and, activated by your voice, they will change to a colour of your choice, whatever suits your mood.

"Much of what will happen in the future depends on what we humans decide to do," says World Future Society President Tim Mack. "If we could know the future with certainty, it would mean that the future could not be changed.

Yet this is a main purpose of studying the future: to look at what may happen if present trends continue, decide if this is what is desirable, and, if it's not, work to change it. Knowing the trends can empower you for effective action."

(A complete version of the forecasts, as well as more information about the Society, can be found at www.wfs.org/tomorrow)

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5 So spodnje trditve pravilne (✓) ali napačne (×)?

- 1 Hydrogen fuel cells will be more expensive than today.
- 2 DNA of living cells will replace silicon chips.
- 3 High-speed planes will be available for passenger transport.
- 4 You could make a lot of money by investing in the Internet.
- 5 Morphine could be bought on a free market.
- 6 The weapons of the future will be less difficult to keep.
- 7 It will be possible to replace the parts of the body.
- 8 Robots will help with taking care of sick and old people.
- 9 The walls in your home will change colour to suit your mood.

6 Ponovno preberite besedilo in podčrtajta napovedi, ki so vas najbolj presenetile. Za katero trditev menite, da se bo uresničila? Kaj bi se lahko uresničilo? Kaj se po vašem mnenju ne bo uresničilo?



Grammar spot: Future prediction and future possibility

Will

- It is used to express a future fact or prediction;
 - We'll be away for two weeks.
 - Their love won't last forever.
- It can be based more on an opinion than a fact;
 - I don't think Jean will come this weekend. He's too busy.
 - I am convinced that the prices of petrol will fall next year.



Will

May/might/could

May / might / could

May, might and could are modal verbs. They all express a future possibility.

I	may might could	see you later.
---	-----------------------	----------------

I	may not might not	get the job.
---	----------------------	--------------

Questions about future possibility are often asked with *Do you think.....will.....?*

- Do you think you'll get the job?

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VAJE

1 Kaj mislite, da se bo zgodilo?

V skupinah postavljajte vprašanja z *Do you think...will...?* Odgovarjajte z *may, might, could* ali *will*.

- 1 the earth / continue to get warmer?

Do you think the earth will continue to get warmer?

Yes, it will, definitely.

I'm not sure.
It might.

I don't think it will.

- 2 all the ice / melt at the poles?
 3 new sources of energy / found?
 4 more people / travel by train?
 5 people / live longer?
 6 extra-terrestrial beings / discovered?
 7 people / talk to animals?

2 Tvorite stavke.

Primer: We haven't decided what we're doing this summer. (may – go to Italy / Spain).

We may go to Italy, or we may go to Spain.

- 1 Let's go and see that new film. (could – be good / be rubbish)
-

- 2 Kate doesn't know what she wants to do when she grows up.
(might – be a doctor / vet)
-

- 3 I can't decide which car I want. (may – buy a Ford / Toyota).
-

- 4 There are two things I'd like to see on TV tonight.
(could – watch a film / the football)
-

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3 Dopolnite stavke z *might not* ali *could not*.

- 1 I _____ have time to come out tonight. I've got one little job to do.
- 2 I _____ be a taxi driver. I can't drive.
- 3 We're going to need lots of plates. We _____ have enough, you know.
- 4 Bruce _____ be in the office tomorrow. He thinks he's getting a cold.
- 5 There _____ be a drama festival this year. We don't know if anyone will be willing to organize it.

4 Dopolnite stavke z *might* in enim od spodnjih glagolov.

bite break need ~~rain~~ slip wake

- 1 Take an umbrella with you when you go out. It _____ might rain later.
- 2 Don't make too much noise. You _____ the baby.
- 3 Be careful of that dog. It _____ you.
- 4 I don't think we should throw that letter away. We _____ it later.
- 5 Be careful. The footpath is very icy. You _____.
- 6 I don't want the children to play in this room. They _____ something.

5 Napišite resnične stavke o sebi.

- 1 I / go for a coffee after class.
- 2 I / go shopping this afternoon.
- 3 I / eat out tonight.
- 4 It / rain tomorrow.
- 5 My children / have holiday on the moon.

I might go for a coffee.

I think / I don't think I'll go for a coffee.



PONOVIMO

1 Kaj lahko vi napoveste? Uporabite naslednje teme:

transport

jobs

food

communications

television

2 WRITING : Using robots at home

Predstavljajte si, da lahko kupite robota, ki popolnoma ustreza vašim željam in zahtevam. Kakšnega bi kupili?

Write the list of pros and cons of using robots at home

Pros	Cons

Upoštevajte svoje razloge ZA in PROTI in napišite kratek sestavek. Uporabite besede in besedne zveze na strani 17.

3 Na spletu poiščite več informacij o :

- a. Automation in everyday life
- b. Robots in medicine
- c. Robots and nanotechnology
- d. Robotics in house appliances

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MEDPREDMETNO POVEZOVANJE

Povezava s slovenščino:

- izdelava dvojezičnega slovarja strokovnih izrazov
- prevajanje

Povezava s praktičnim poukom:

- primere iz prakse znajo povedati v angleščini
- poznajo strokovne izraze v angleščini

Povezava s strokovnimi predmeti (tehniško komuniciranje, tehnološki procesi, mehatronika, informacijski sistemi, krmilno regulacijski sistemi).



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