Unit 32: Industrial Robot Technology

Unit code: H/601/1473
QCF level: 5
Credit value: 15

Aim

This unit will develop learners’ understanding of robots and the skills needed to program them for a range of industrial applications.

Unit abstract

Industrial robots have a wide range of applications, especially in the manufacturing and engineering sectors. This unit will develop learners’ understanding of the key elements of industrial robots and how they are linked together as a system – manipulator, control and intelligence and sources of system errors. Learners will then develop and apply the skills used to program robots for industrial tasks (for example welding, assembly, machining, etc), and investigate the various programming methods and facilities that are available. Finally, the unit covers the design of an efficient, safe robot cell, and the factors that must be taken into account when selecting, installing and operating industrial robots. This should also include the economic and ethical issues that surround the introduction of robot technology.

Learning outcomes

On successful completion of this unit a learner will:
1. Understand the key elements of industrial robots
2. Be able to program an industrial robot
3. Be able to design a robot cell and plan its implementation.
Unit content

1 Understand the key elements of industrial robots

Manipulator elements: electrical and fluid drive systems eg harmonic, cycloidal, shaft, rod, screw, belt, chain; sensors eg absolute and incremental encoders, potentiometers, resolvers, tachometers; brakes; counterbalance devices

Control elements: CPU; system and user memory; interface modules; power modules

Intelligence: relating to proximity, range, position, force, temperature, sound and gas

Sources of error or malfunction: environmental contamination eg smoke, arc-flash, dirt, fluids, heat; parallax; wear; data corruption; accessibility; sensitivity; accuracy; design

2 Be able to program an industrial robot

Programming methods: task programming; manual data input; teach programming; explicit programming; goal-directed programming

Facilities: conditional loops; datum shifts; location shifts; interrupts; peripheral communications; TCP offsets; canned cycles; macros

Industrial tasks: eg welding; assembly; machining; gluing; surface coating; machine loading

Setting up and executing the program: program/location input; start-up inter-locking; program testing; fine-tuning; automatic operation

3 Be able to design a robot cell and plan its implementation

Design parameters: layout; cycle times; control; accessibility; error detection; component specification; protection of the robot and peripherals, future developments; hazard analysis eg human, robot design, robot operation, workplace layout, hardware failure, control system failure, control system malfunction, software failure, external equipment failure, external sensor failure; guarding; fencing; intrusion monitoring; safe system of work; restriction mechanisms

Selection criteria: accuracy; repeatability; velocity; range; operation cycle time; load-carrying capacity; life expectancy; reliability; maintenance requirements; control and play-back; cost; memory; fitness for purpose; working envelope

Design: station configuration; parts presentation; fixtures; parts recognition; sensors; cell services; safety interlocks; end effector design; flexibility

Implementation factors: company familiarisation; planning; robot manufacturer back-up; economic analysis and ethical implications; installations scheduling; training
## Learning outcomes and assessment criteria

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<td><strong>On successful completion of this unit a learner will:</strong></td>
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| LO1 Understand the key elements of industrial robots | 1.1 analyse the key elements of a robot manipulator and their principles of operation  
1.2 describe the main control elements of a robot system and explain their functions  
1.3 describe the devices and methods used to improve the intelligence of a robot  
1.4 investigate the possible sources of error or malfunction in an industrial robot system |
| LO2 Be able to program an industrial robot | 2.1 describe common programming methods  
2.2 describe the facilities available in a structured robot program  
2.3 generate a robot program to simulate an industrial task using a structured technical language  
2.4 set up the robot and execute the program so that the robot functions safely and efficiently |
| LO3 Be able to design a robot cell and plan its implementation | 3.1 identify and evaluate the parameters which relate to the design of an efficient and safe robot cell  
3.2 describe the criteria which must be considered in the selection of a robot for an industrial application  
3.3 design a robot cell for an industrial application  
3.4 describe the factors which must be considered in the implementation of a robot cell. |
Guidance

Links
There are no links for this unit.

Essential requirements
Centres delivering this unit must be equipped with, or have access to, industrial-standard robots and programming facilities.

Employer engagement and vocational contexts
Visits to industrial installations will be of value to reinforce learning activities and enable the learner to appreciate the scope of and impact that robot technology can have in an industrial setting.