Introduction

The term ‘robot’ was introduced to the world by the Czech playwright Karel Capek in 1920–1 in his play *R.U.R.* (Rossum’s Universal Robots). The word ‘robot’ was used in this play to describe a mechanical man. Various sources indicate that the word comes from the Czech words *robota* (compulsory labour), *robotit* (to drudge), or *robotnik* (workman, farm labourer or serf). The robots of science fiction are rapidly becoming reality.

Isaac Asimov describes the Three Laws of Robotics in his book *Robots and Empire*. Set in the year 2058 AD, the three laws are stated as:

‘A robot may not injure a human being, or through inaction, allow a human being to come to harm.

A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

And a further law, the Zeroth Law of Robotics, states:

*There is a law that is greater than the First Law: A robot may not injure humanity, or through inaction, allow humanity to come to harm.

The First Law should then be stated: A robot may not injure a human being, or through inaction, allow a human being to come to harm, unless this would violate the Zeroth Law of Robotics.*’

Issac Asimov
Robs and Empire

‘“There you are!” he said with pride in his voice. “Robots only! Five men act as overseers and they don’t even stay in this room. In five years, that is, since we began this project, not a single accident has occurred. Of course the robots here assembled are comparatively simple, but . . .”'
The General Manager's voice had long died to a rather soothing murmur in Gloria's ears. The whole trip seemed rather dull and pointless to her, though there were many robots in sight. None were even remotely like her Robbie, though, and she surveyed them with open contempt.

In this room there weren't any people at all, she noticed. Then her eyes fell upon six or seven robots busily engaged at a round table halfway across the room. They widened in incredulous surprise. It was a big room. She couldn't be sure, but one of the robots looked like - looked like - it was!

"Robbie!" Her shriek pierced the air, and one of the robots about the table faltered and dropped the tool he was holding. Gloria went almost mad with joy. Squeezing through the railing before either parent could stop her, she dropped lightly to the floor a few feet below, and ran towards her Robbie, arms waving and hair flying.

And the three horrified adults, as they stood frozen in their tracks, saw what the excited little girl did not see, - a huge, lumbering tractor bearing blindly down upon its appointed track...

It was only Robbie that acted immediately and with precision.

With metal legs eating up the space between himself and his little mistress he charged from the opposite direction. Everything then happened at once. With one sweep of an arm, Robbie snatched up Gloria, slackening his speed not one iota... The tractor intersected Gloria's path half a second after Robbie had, rolled on ten feet further and came to a grinding, long drawn-out stop.

Gloria regained her breath, submitted to a series of passionate hugs on the part of both her parents and turned eagerly toward Robbie. As far as she was concerned, nothing had happened except that she had found her friend.

"Well," said Mrs Weston at last, "I guess he can stay with us until he rusts."

Issac Asimov
Robbie
There seems no doubt that the ‘Robbies’ of science fiction will one day join us as co-inhabitants of the Earth and co-explorers of space. However the robots of today are much less glamorous than those of science fiction but despite that are extremely useful, particularly in industry.

Although we have come to understand the word ‘robot’ to mean a machine which looks rather like a human and moves and performs actions in a humanlike manner, it can mean something much simpler. Any machine which copies an action normally done by humans can be described as a robot.

**Early Robots**

The first industrial robot, which consisted simply of a fixed base and an arm with very limited movement, was used to spot-weld automobile bodies on motor car assembly lines. This task showed the versatility of the industrial robot and prompted industrialists to consider other tasks which could be performed more effectively by a machine than a human. Soon robots were used in dye casting and forging, two extremely unpleasant occupations for humans, and in spray-painting and seam welding, two tasks which require precise and regular hand movements.

These first industrial robots were non-sensory robots. They had no sense of touch or sight and certainly no sense of smell, taste or hearing. The next object on the assembly line would simply trip a switch as it came into range and the robot would swing into a predetermined set of actions, following a set of commands with which it had been programmed.

**How a Robot Works**

Each movement along an axis, or in other words movement in a single direction, is considered to be a degree of freedom. Robots commonly have between three and six degrees of freedom. A robot with six degrees of freedom has most commonly three ‘wrist’ movements:

- rotation or swivel
- up and down or bend
- right and left or yaw