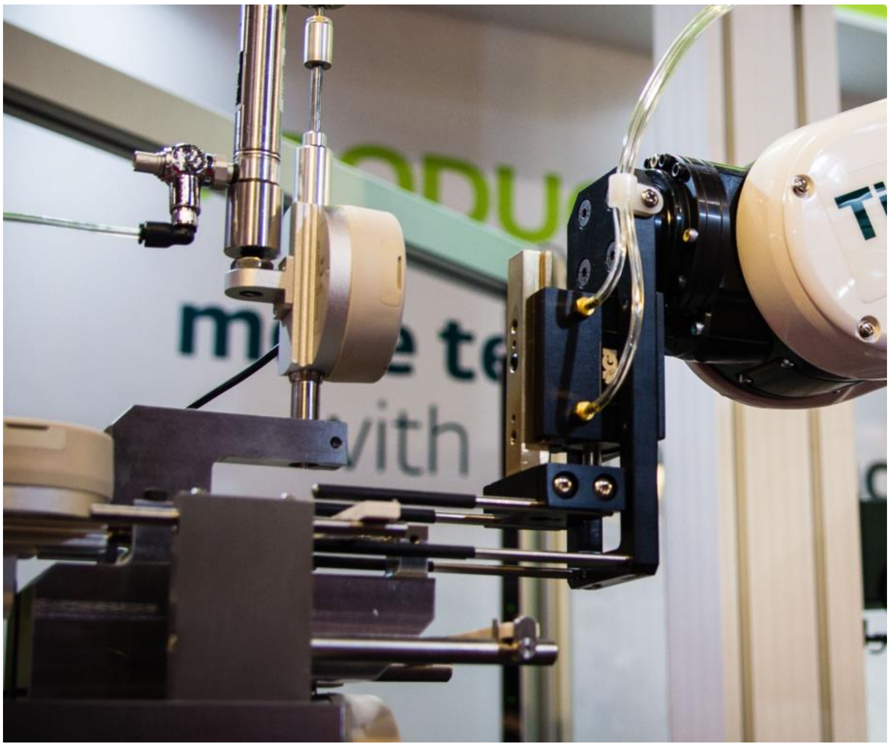
Putting Robots to the Test

Successful manufacturing relies on quality and productivity. Testing machines are used to demonstrate the quality of raw materials such as steel alloys, composites, plastics and rubber as well as components including medical devices, packaging materials and fasteners. Manufacturing processes today are typically automated to a greater or lesser extent, although the quality process is often manual.

This is generally time consuming, involving entering reference data, performing test procedures, reporting on the results, preparing the testing machine, starting the test, qualifying and accepting the results and appending comments before removing the materials.

Historically, materials testing has been an operator using single or multiple stations. This can be uneconomical in terms of operator time where speed is crucial – for example in testing threaded fasteners for the aerospace industry, testing is required 24 hours a day.



Drug delivery in the biomedical industry is one sector that could benefit from automation. Drug delivery tests are performed on three individual stations with multiples of those stations, lab operators working 24 hours a day loading, testing and removing the parts – this can now be automated.

However, there is a discrepancy in manufacturing where businesses are happy to pay for the automated manufacturing of products. The testing of the materials used in the products is still based in the domain of manual workers – no matter the size of the business or its industry. The high cost of introducing automated testing into the manufacturing process, and whether a business believes it has the volume of samples to justify them, has been a barrier to smaller companies considering spending the money to supplant human operators carrying out material tests with robots.

This has resulted in the development of scalable automated testing systems, which can offer manufacturing businesses an alternative to manual testing, with long-term benefits.

Figures by Tinius Olsen, UK, claim there are gains to be made, noting that an operator can spend 8.4 hours per 24-hour day watching and waiting for tests to run. A robotic system can run all day and night, leading to weekly gains of 59 hours against an operator, amounting to 127 days over the course of a year. This means more tests can be undertaken with increased productivity.

The technology can be designed, developed and scaled up or down to fit a business' needs and be versatile to accommodate any material or components. The idea is it can run single or multiple tasks at any size or combination. Creating a scalable building block approach allows for systems from low force applications of just a few newtons to very high force applications of a thousand kilonewtons or more.

Olsen's first machine, built in 1891, the Little Giant, was the first to combine and accurately perform tensile, transverse and compression tests in one instrument housed in a single frame. This same design approach is now seeing developments in fully automated testing, whereby multiple machines can be placed into a cell with a single robot control. This can feed multiple materials carrying out tests including hardness, tensile strength and flexibility.

Accelerating automation

Automation has crept into materials testing, but it is often limited to devices that hold the testing specimens, such as in semi-automation around heavy metal testing or systems, usually testing rigid raw materials in tensile only parameters. As part of an automated testing solution, a number of options exist in terms of different tests performed at a range of capacities. The different testing options include not just a horizontal or vertical tensile test but also a flexural test, a hardness test and/or any other type of physical testing equipment that can export test data.

When companies review automated processes in terms of manufacturing, they should apply the same business rationale to their quality lab. Often, they believe it can't be done, or there's not enough throughput to justify its introduction. But, by taking into consideration the time it takes to do a test and the need for repeatability – an eight-hour shift, six days a week requirement – significant money can be made and not just saved by automating the quality control.

Automation has been incorporated into a number of testing machines including the tensile tester – it has either a vertical orientation or a horizontal orientation, consisting of an electromechanical tensile tester, which is available in a selection of maximum test capacities. Testing in the horizontal plane allows the use of a precision extensometer that takes advantage of gravity to rest on
and follow the specimen as it is pulled to break. Using air bearings and a non-slip finish on the knife-edges of the extensometer achieves Class A accuracy.

The primary test station features, for example, a 600kN test station. Using open front crossheads on the tester allows the robot to place the sample into the tester and the hydraulic grips can be easily closed. Extensometry is achieved using either standard non-contacting extensometers or an automatic clip on extensometer. The advantage of an integrated and robotic test system is the ability to test a large number of specimens leaving operators available to perform other types of quality tests.

Large amounts of materials are stored in a way that allows easy access for the
robotic arm to grab the next specimen. These storage systems can be simple specimen racks that are arranged in an arc around the robot arm. The robot moves around to
pick the next specimen, or multiple large storage racks are pneumatically moved into position so that the robot returns to the same place to collect the next specimen.

Gathering data

Once a material has been selected, it is important to know as much as possible and each should be identified, most commonly with a barcode. The barcode holds information about the material and can be read into the testing machine software. Alternatively,
the barcode can trigger an import of data into this software. Information may include identifiers, test parameters, result limits or any other relevant data. The robot can be programmed to move the material from station to station, rotating the material to
be loaded either horizontally, vertically or at any angle in between, depending on the requirements. It controls the movement of the specimen through the different testing routines, but it also listens to input from other external testers and will place these

results into a summary report.

Businesses will benefit from the productivity and repeatability of automation – the machine can be used every hour of every week. With optimisation, speed, efficiency and cost at the centre of automated solutions, robotics may hold the answer in future testing facilities.

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