

50 Years of Robotics

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In this issue, we celebrate the 50 years of robotics, following up on the theme from this year's IEEE International Conference on Robotics and Automation (ICRA) held in Anchorage, Alaska. The exact beginning of robotics is difficult to pin down and the topic for future historians of our field. Humankind has a long fascination with machines built in our image. Such machines were mentioned by the ancient Greeks, described by Al-Jazari in the 13th century, and designed by Leonardo da Vinci in the 15th century. Human- and animal-like machines, automata, were a major fad in Europe in the 18th century with the flute player, the musician, the draughtsman, and the digesting duck. The term robot was coined in a 1920s play by Karel Čapek, and Isaac Asimov published his first robot story in 1940. A common theme was the creation or the depiction of a machine that could emulate a human.

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William Grey Walter, a cybernetics researcher, built a mobile robot in 1948 that could seek out a light source and a recharging station. The artificial intelligence (AI) movement was founded at the Dartmouth conference in 1956 and led to new research in robotics at universities in the United States, Europe, and Japan. The first humanoid robot was developed in Waseda University in 1973.

The roots of industrial robotics could be traced back to the work of Ray Goertz at Argonne National Laboratory in the late 1940s, who developed remote-controlled manipulator arms for handling radioactive material. George Devol's 1954 patent on Universal Automation (Unimation) describes a polar coordinate arm on a linear track that was controlled by magnetic signals on a revolving drum. The machine was programmable, and thus, the archetype of the modern industrial robot. He met Joseph Engelberger and they founded Unimation in 1956, which a short time later became Unimation Inc. a division of Consolidated Diesel Corp. (Condec). Fifty years ago, in 1960, they shipped their first robot to a General Motors' die-casting plant in New Jersey. The rest is history!

This year marks the 50th anniversary of robotics. A number of international events have been organized celebrating the many accomplishments of the field in the last five decades. ICRA 2010 featured keynote speakers in the core technology areas (control, perception, learning, and planning) and application domains (medical and life sciences, industrial robotics and automation, energy, environment and society, and field robotics), who provided an excellent perspective of the past and future challenges in robotics research and development. The articles in this special issue are drawn from presentations at the "Celebrating 50 Years of Robotics" symposium held at the University of Pennsylvania on 11 December 2009. The celebration will continue at the Intelligent Robots and Systems 2011 in San Francisco with special symposia in different subfields of robotics.

This issue features three articles drawn from presentations at the symposium in 2009 that describe new directions for robotics research. Okamura et al. discuss new opportunities for robotics and automation in medicine and life science and outline an aggressive research agenda that has the potential to dramatically impact health care and our quality of life. Gilpin and Rus describe challenges in creating programmable matter, modules with embedded sensing, actuation, and computing that can self-assemble and organize into various smart, functional machines. Michael et al. present novel cooperative aerial robotic systems that represent new capabilities with new research challenges for ensembles of micro air vehicles.