



Sensing, Intelligence, Motion: How Robots and Humans Move in an Unstructured World

Vladimir J. Lumelsky

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A leap forward in the field of robotics

Until now, most of the advances in robotics have taken place in structured environments. Scientists and engineers have designed highly sophisticated robots, but most are still only able to operate and move in predetermined, planned environments designed specifically for the robots and typically at very high cost. This new book takes robotics to the next level by setting forth the theory and techniques needed to achieve robotic motion in unstructured environments. The ability to move and operate in an arbitrary, unplanned environment will lead to automating a wide range of new robotic tasks, such as patient care, toxic site cleanup, and planetary exploration.

The approach that opens the door for robots to handle unstructured tasks is known as Sensing-Intelligence-Motion (SIM), which draws from research in topology, computational complexity, control theory, and sensing hardware. Using SIM as an underlying foundation, the author's carefully structured presentation is designed to:

- * Formulate the challenges of sensor-based motion planning and then build a theoretical foundation for sensor-based motion planning strategies
- * Investigate promising algorithmic strategies for mobile robots and robot arm manipulators, in both cases addressing motion planning for the whole robot body
- * Compare robot performance to human performance in sensor-based motion planning to gain better insight into the challenges of SIM and help build synergistic human-robot teams for tele-operation tasks. It is both exciting and encouraging to discover that robot performance decisively exceeds human performance in certain tasks requiring spatial reasoning, even when compared to trained operators
- * Review sensing hardware that is necessary to realize the SIM paradigm

Some 200 illustrations, graphic sketches, and photos are included to clarify key issues, develop and validate motion planning approaches, and demonstrate full systems in operation.

As the first book fully devoted to robot motion planning in unstructured environments, Sensing, Intelligence, Motion is a must-read for engineers, scientists, and researchers involved in robotics. It will help them migrate robots from highly specialized applications in factories to widespread use in society where autonomous robot motion is needed.

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