

14:00 Bases mathématiques du mouvement en robotique

Mathematical bases of robot motion

Jean-Paul Laumond, LAAS-CNRS, Toulouse



Jeudi 9 octobre

Robot Motion Planning is an active research area in Robotics for almost 30 years. A geometric model of the environment being given, the goal is to provide a mechanical system with the capacity of computing motion strategies to avoid the obstacles in an autonomous way. The problem of moving a mechanical system made of 3-dimensional bodies can be formulated as the problem of moving a point in the so-called system configuration space. This statement, borrowed from Mechanics, reduces the motion planning problem to the search of connected components in the collision-free configuration space.

How to transform this continuous problem into a combinatorial one?

The talk will give an overview of the relevant mathematical approaches ranging from algebraic geometry to differential geometry via discrete geometry. Successful results will be illustrated in areas of robot programming, mobile robots, and beyond Robotics in Product Lifecycle Management or molecular modeling.

After presenting some challenging open mathematical problems in robot motion planning, the talk will conclude on a current opening of robot motion studies towards neurosciences.

Jean-Paul Laumond is Director of Research at LAAS-CNRS. He received the M.S. degree in Mathematics, the Ph.D. in Robotics and the Habilitation from the University Paul Sabatier at Toulouse in 1976, 1984 and 1989, respectively. From 1976 to 1983 he was teacher in Mathematics. He joined CNRS in 1985. In Fall 1990 he has been an invited senior scientist at Stanford University. He has been a member of the French *Comité National de la Recherche Scientifique* from 1991 to 1995. He is currently co-director of the French-Japanese AIST-CNRS laboratory JRL on Humanoid Robotics.

From 1992 to 1995, he has been coordinator of two the European ESPRIT projects PROMotion (Planning RObot Motion, 1992-1995) and MOLOG (Motion for Logistics, 1999 - 2002), both dedicated to robot motion planning technology. In 2001 and 2002 he created and managed Kineo CAM, a spin-off company from LAAS-CNRS, devoted to develop and market motion planning technology. Kineo CAM was awarded the French Research Ministry prize for innovation and enterprise in 2000 and the IEEE-IFR prize for Innovation and Entrepreneurship in Robotics and Automation in 2005.

His current research is devoted to human motion studies along three perspectives: artificial motion for humanoid robots, virtual motion for digital actors and mannequins, and natural motion of human beings.

He teaches Robotics at ENSTA and Ecole Normale Supérieure in Paris. He has edited three books. He has published more than 100 papers in international journals and conferences in Computer Science, Automatic Control, Robotics, recently including Neuroscience. He is IEEE Fellow, IEEE Distinguished Lecturer, Editor of the IEEE Transactions on Robotics and member of the IEEE RAS AdCom.