



Stochastic Models in Robotics

Gregory Chirikjian -- Johns Hopkins

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Abstract: Many stochastic problems of interest in engineering and science involve random, rigid-body motions. In this talk, a variety of stochastic phenomena that evolve on the group of rigid-body motions will be discussed together with tools from harmonic analysis and Lie theory to solve the associated equations. These phenomena include mobile robot path planning and camera calibration. Current work on multi-robot team diagnosis and repair, information fusion, and self-replicating robots will also be discussed. In order to quantify the robustness of such robots, measures of the degree of environmental uncertainty that they can handle need to be computed. The entropy of the set of all possible arrangements (or configurations) of spare parts in the environment is one example of such a measure and has led us to study problems at the foundations of statistical mechanics and information theory. These and other topics in robotics lend themselves to the same mathematical tools, which also will be discussed in this talk.



Dr. Gregory S. Chirikjian received undergraduate degrees from Johns Hopkins University in 1988, and a Ph.D. degree from the California Institute of Technology, Pasadena, in 1992. Since 1992, he has served on the faculty of the Department of Mechanical Engineering at Johns Hopkins University, attaining the rank of full professor in 2001. Additionally, from 2004-2007, he served as department chair.

Chirikjian's research interests include robotics, applications of group theory in a variety of engineering disciplines, and the mechanics of biological macromolecules. He is a 1993 National Science Foundation Young Investigator, a 1994 Presidential Faculty Fellow, and a 1996 recipient of the ASME Pi Tau Sigma Gold Medal. In 2008, Chirikjian became a fellow of the ASME, and in 2010, he became a fellow of the IEEE. From 2014-15, he served as a program director for the National Robotics Initiative, which included responsibilities in the Robust Intelligence cluster in the Information and Intelligent Systems Division of CISE at NSF. Chirikjian is the author of more than 250 journal and conference papers and the primary author of three books, including *Engineering Applications of Noncommutative Harmonic Analysis* (2001) and *Stochastic Models, Information Theory, and Lie Groups*, Vols. 1+2. (2009, 2011). In 2016, an expanded edition of his 2001 book was published as a Dover book under a new title, *Harmonic Analysis for Engineers and Applied Scientists*.

Hosted by Miroslav Krstic
and Jorge Cortes