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RESEARCH ON MULTIPARAMETRIC STOCHASTIC PROCESSES

Final Report

by

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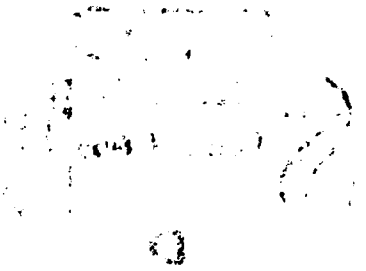

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The principal accomplishments of this research project are in two areas: (a) the introduction of stochastic differential forms, and the application of this concept to the study of multidimensional martingales and Markov Processes; and (b) the development of a family of algorithms and techniques for representing and processing geometric shapes.

Martingales are the natural result of filtering and estimation of signals corrupted by noise. Markov processes, on the other hand, are models of signals and noise that lead to simple processing algorithms. For higher dimensional signals and noise such as images, these concepts are considerably more complex and lead naturally to generalized processes and vector fields that require a new framework. We have established such a framework in the form of stochastic differential forms. The basic results are reported in [1], and applications are reported in [2,3].

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A second body of results concerns the representation and processing of graphical and pictorial information. Two major concepts were developed in this connection. First, a novel data structure, called arc-tree, for representing continuous curves was introduced [4]. This structure is designed to achieve highly efficient operations such as intersection and point location. Second, representing polygons in "dual space" was explored. This involves representing convex polygons as the intersection of half-planes, and general polygons as a sum of convex polygons. Some of algorithm developed [5] are the most efficient known to date.

1. E. Wong and M. Zakai, "Multiparameter Martingale Differential Forms," Prob. Th. and Rel. Fields, 74 (1987) 429-453.

2. E. Wong and M. Zakai, "Isotropic Gauss-Markov Currents," accepted by Prob. Th. and Rel. Fields.

3. E. Wong, "Multiparameter Martingales and Markov Processes," 4th Bad Honnef Conference on Stochastic Differential Systems, June 20-24, 1988, West Germany.

4. O. Gunther and E. Wong, "The Arc Tree: An Approximation Scheme to Represent Arbitrary Curved Shapes," submitted to J. of Computer Vision, Graphics and Image Processing.

5. O. Gunther and E. Wong, "A Dual Space Representation for Geometric Data," Proc. 1987 VLDB Conference, Brighton, England, September 1-4, 1987.