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"On the Conditional Density Equation in Nonlinear Filtering Problems"

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ON THE CONDITIONAL DENSITY EQUATION IN NONLINEAR FILTERING PROBLEMS, G. L. Blankenship and J. S. Baras (Electrical Engineering Department, University of Maryland, College Park, Md. 20742). We consider the unnormalized conditional density equation arising from a very simple, albeit nontrivial, nonlinear filtering problem. After establishing existence and uniqueness of solutions for this stochastic partial differential equation, we derive an expression for the solution as a "doubly stochastic" Feynmann-Kac pathintegral. The results are extensions of previous results by Pardoux, Chow and others, in that certain operators appearing in this stochastic partial differential equation are unbounded. We then consider the problem of computing the requisite Wiener integral in exact or approximate form. In a different direction an "assumed density" approximation method is applied to this specific stochastic p.d.e. Certain relations with quantum filtering problems are discussed and the possibility of a direct "distributed" implementation is investigated. Finally we show how by appropriate nonlinear transformations, these ideas and techniques can be extended to an interesting class of nonlinear filtering problems with multiplicative noise.