Final Report for 2010-2011
Faculty Research Grant

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I received a 2010 - 2011 Faculty Research Grant of $3,500 as a summer stipend for the project "*Piecewise Polynomial Approximations of Stochastic …*" In this project, my main goal was to estimate the error of the solution to a stochastic Robin boundary value problem. After working on this project for several months, I found that it was very difficult to have a priori error estimate for the solution of the problem (even for deterministic problems). I knew that without this error estimate, I could not extend my result to a stochastic control problem (my major research area) constrained by the stochastic elliptic partial differential equation. For that reason, I changed the direction of my project to the stochastic elliptic problem with the homogeneous boundary condition under minimal regularity assumptions on the solution (i.e., I tried to solve the problem with fewer assumptions on the solution).

Fortunately, this modified project was successful; I was able to find many results. Under the minimal regularity assumptions on the solution (the literature generally assumed higher regularity than my project), I showed the existence and uniqueness of the solution, established the convergence of the solution, and derived error estimates for the solution (the latter is a main result that can be used to extend my result to the stochastic control problem with the stochastic elliptic partial differential equation). Currently, I am working on implementing a computer program to simulate my stochastic mathematical model (this could be part of another project).

I appreciate the funds UMW provided for me to do this project. My work will be written up shortly in the form of an article to be submitted to a referred applied mathematics research journal. I was invited to give six lectures about stochastic problems including my new results to math faculty and graduate students at Ajou University in South Korea in the winter of 2010. I also gave an invited talk at the National Institute for Mathematical Sciences in South Korea during my visit to South Korea. In addition, I will give an invited talk at an international-level conference between Korea and USA in the summer of 2011. I already used some ideas from my research results in my research students' projects on heat conduction models and numerical models of chemical pollutant diffusion; for example, my students used my polynomial approximation idea to the solution in their undergraduate research projects on simple domains such as a 1-dimentional interval and a 2-dimentional rectangle. I believe my new results will give me an opportunity to enhance my future PDE course in the spring of 2012.