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ON

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PROJECT TITLE: Random Equations in Aerodynamics

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INTRODUCTION

In our proposal we stated that in the first year we would: (1) review the literature to identify those aerodynamic models that might be treated by more modern probablistic methods, and then analyze them; (2) investigate the numerical solution of some integral equations that arise in aerodynamical problems; and (3) on the basis of our numerical studies try to develop a qualitative theory of the random integral equations that we consider in aerodynamics, that is, to develop a theory which will provide us with information about the behavior of the solutions of these equations (in particular, boundary and asymtotic behavior, and stability) and their statistical properties without actually obtaining explicit solutions of the equations.

CONTRACT ACTIVITIES

An algorithm for the solution of random Wiener-Hopf integral equations has been developed. This is a probabilistic version of an approximation method due to Frank Stenger ("The Approximate Solution of Wiener-Hopf Integral Equations," J. of Mathematical Analysis and Applications, vol. 37, pp. 687-724, 1972). We are currently investigating the convergence properties of our algorithm; and will implement the same for numerical computation of Random Weiner-Hopf equations that arise when an aerospace structure is subjected to random gusts.

An algorithm has also been developed for the solution of Random Cauchy Integral Equations. This is a probabilistic version of an approximation method due to Fromme and Golberg ("Integral Equations for Flows in Wind Tunnels," J. of Integral Equations, vol. 1, pp. 249-273, 1979), who developed their theory for the solution of Singular Cauchy Integral Equations that arise in the study of wing structures and wind tunnels. We are investigating the convergence properties of our algorithm and will also implement it for numerical calculations. In Golberg's papers, the forced properties are reflected in the kernel. In our research, we introduce random parameters in the kernel and assume their mean values are those used by Golberg, hence obtaining a probabilistic generation of the class of equations studied by Golberg.