EXTREME GROUND EFFECT

by

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SUMMARY

The work presented in this thesis involves an analysis of thin bodies moving in extreme ground effect; that is, in close proximity to a plane ground surface.

In chapter 1, a brief introduction to the study of extreme ground effect is given and the purpose and scope of this thesis presented.

In chapter 2, some applications of the one dimensional gap flow problem are discussed. In particular, the aerodynamics of the read–write heads on computers are investigated for both hard discs and elastic discs. Some suggestions for other applications are made.

In chapter 3, the extreme ground effect problem for a thin body of general planform is detailed. The partial differential equation governing the two dimensional flow in the gap and the associated leading edge and trailing edge boundary conditions are derived in the limit as the clearance tends to zero, using the method of matched asymptotic expansions.

A boundary integral equation method to solve the resulting equations is developed in chapter 4 for the special case when the clearance between the body and the ground is constant in y and exponential in x. This method incorporates analytical and numerical techniques in approximating the integral equation by a matrix equation.

In chapter 5, the location of the transition point between the leading edge and the trailing edge is investigated for two special cases. Firstly, some theory is developed to determine the location of the transition point for thin bodies with low aspect ratio, and is illustrated using elliptical bodies. Secondly, the transition point location is studied for bodies with planforms which are near–rectangles. This results in a conclusion being made for rectangular bodies.

In chapter 6, the theory and integral equation method are applied to problems in which the transition points between the leading edge and the trailing edge are fixed. Skirts (as used in some racing cars) are incorporated, and comparisons are made for bodies with and without skirts. An inverse solution is developed and used as a comparison for the program.

Some concluding remarks and also some suggestions for further research in this area are made in chapter 7.