

## CHAPTER II

UNSTEADY HYDROMAGNETIC FREE CONVECTIVE  
FLOW PAST AFLUCTUATING VERTICAL FLAT PLATE  
WHOSE TEMPERATURE FLUCTUATES  
HARMONICALLY

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## I. Introduction

Engineering processes in which a fluid supports an exothermic chemical or nuclear reaction are very common today and the correct process design requires accurate correlations for the heat transfer coefficients at the boundary surfaces. Despite its increasing importance in technological and physical problems, natural convection studies with generation have not received such attention. Calculation of temperature of a closed turbine blade or the throat of a rocket nozzle involves convective heat transfer alone but if a fluid is injected through the surface, the problem is a mass transfer one. Mass transfer finds its place in ablative cooling (sudden decrease in the temperature of space vehicles during their re-entry into the atmosphere), transpiration and film cooling of rocket and jet engines. Further, the effects of variable suction and the flow past an infinite, vertical plate in the presence of free convection currents, will be found useful in the study of aircraft response to atmospheric gusts, in airfoil lift hysteresis at the stall, in flutter phenomena involving wing and in the prediction of the flow through turbomachinery blade cascades. The two dimensional unsteady flow of an incompressible viscous fluid, when the free stream oscillating about a nonzero -

constant mean, has been studied by Karman-Pohlhausen method by Lighthill(4). Taking the free stream oscillations into accounts Stuart(5), has analysed the forced flow and heat transfer from an infinite porous plate. Soundalgekar(8) has studied the free convection effects and the oscillatory flow of an incompressible viscous fluid past an infinite vertical plate with variable suction. Krishnalal(3) has investigated the application of fluctuating suction to free stream laminar flow past a porous vertical wall. Shastri and Bhadran (7) have studied Hydromagnetic convective heat transfer in vertical pipes. Rudraiah and Nagaraj (6) have studied the free ~~flow~~ convection effects on the flow through porous vertical stratum.

The problem of thermal convection a situation in which the buoyancy forces are generated only by temperature gradients, has been considered by many researchers. Minkowicz and Eckert(10), Gebhart and Pera (1) and many others (2) have considered the problem of free convection, which takes into account the buoyancy effects, has been presented in the case of semi infinite plates without considering the effects of suction and neglecting the dissipative heat, on the free convective flow.

In this chapter our aim is to study the unsteady free convective hydromagnetic flow past an infinite vertical flat plate with variable suction under the influence of a uniform transverse magnetic field. The expression for the fluctuating parts of the velocity, the transient velocity, temperature and





















































































































































