

# CONTENTS

HISTORICAL INTRODUCTION	1
PART I: MAGNETOHYDRODYNAMICS	
I GENERAL PRINCIPLES	19
<i>The equations of magnetohydrodynamics. Dimensional analysis. The electrical state of a conducting fluid in motion. The electromagnetic effects and the magnetic Reynolds number. Alfvén's theorem on the conservation of magnetic flux in a moving conducting fluid. The Law of isorotation. The magnetic and viscous stresses.</i>	
II MAGNETOHYDROSTATICS AND STATIONARY STATES	32
<i>Magnetohydrostatic problems. Force-free magnetic fields. Pressure-balanced magnetohydrostatic configurations. The stability of magnetohydrostatic configurations. Steady laminar motion. Engineering experiments.</i>	
APPENDIX TO CHAPTER II	53
<i>The vector wave equation. Toroidal and Poloidal vector fields.</i>	
III MAGNETOHYDRODYNAMIC WAVES	57
<i>Waves in an infinitely conducting fluid. Alfvén waves. Magnetohydrodynamic waves in a compressible fluid: longitudinal magnetohydrodynamic waves. Magnetohydrodynamic waves in a non-uniform magnetic field. The reflection and refraction of Alfvén waves: propagation in a stratified medium. Dissipative effects.</i>	
IV TURBULENCE	77
<i>Introduction. Transference and dissipation of energy in turbulent motion. Spectral analysis. Homogeneity and isotropy. Kolmogoroff's principle. Hydromagnetic turbulence. Inhibition of turbulence by a magnetic field.</i>	

V	HYDROMAGNETIC SHOCK WAVES	85
	<i>Introduction. Stationary plane shock waves in the absence of a magnetic field. Plane hydromagnetic shock waves. The structure of a hydromagnetic shock wave. The hydromagnetic bore wave.</i>	
	PART II: PLASMA DYNAMICS	
VI	THE MOTION OF A CHARGED PARTICLE IN A MAGNETIC FIELD	101
	<i>General characteristics. The equation of motion of a charged particle in crossed electric and magnetic fields. The motion of a charged particle in a uniform magnetic field. Magnetic moment. Particle drifts in an inhomogeneous magnetic field: adiabatic invariant. Drifts produced by a field of force in the presence of a magnetic field. The motion of a charged particle in the field of a magnetic dipole. Magnetic bottles.</i>	
VII	DYNAMICS OF A PLASMA	114
	<i>Introduction. Definitions. Mean values of functions of molecular velocities. Boltzmann's equation. The steady state. Relaxation towards the steady state. The equations of continuity and motion for a simple gas. The equations for a plasma. Approximate calculation of the collision terms. The existence of a time of relaxation. Electrical neutrality: the Debye distance. Collision interval and mean free path in a plasma. Numerical values. Approximate evaluation of the distribution function for the electrons. Electric currents in a plasma. Electrical and thermal conductivities in a plasma at rest. Modifications due to the presence of the magnetic field. Correction to the integrals <math>J_1, J_2, J_3</math>. The various conductivities: dissipation of energy. The equation of diffusion. Vorticity theorems.</i>	
VIII	WAVES IN A PLASMA	151
	<i>Introduction. Electrostatic waves. Electromagnetic and hydromagnetic waves. Waves in collision-free plasmas.</i>	
	BIBLIOGRAPHY	169
	INDEX	179