
Contents

1. General Ideas and Simple Applications	1
1.1 Introduction.....	1
1.2 Equations.....	2
1.3 Electromagnetic Effects.....	4
1.31 Frozen-in Fields.....	7
1.32 Magnetic Energy.....	8
1.4 Mechanical Effects.....	9
1.5 Parallel Flow.....	13
1.51 Comparison with Experiment.....	15
1.6 Magnetic Rigidity.....	17
2. Magnetohydrostatics	20
2.1 The Magnetohydrostatic Problems.....	20
2.2 Sunspot Equilibrium.....	21
2.3 Streamers and Filaments.....	23
2.4 Magnetohydrostatic Stability.....	29
2.5 Spiral Arms.....	31
3. Wave Motion	34
3.1 Magnetohydrodynamic Waves.....	34
3.2 Discussion of m.h. Waves.....	36
3.21 Dissipative Effects.....	37
3.22 Compressibility.....	38
3.23 Nonuniformity.....	39
3.3 Experimental Results.....	41
3.4 Stellar Rotation.....	44
3.41 The Torsional Theory of Sunspots.....	47
3.5 Alfvén's Theory of Sunspots.....	50
3.6 Magnetic Variable Stars.....	53
4. Magnetic Fields and Instability	56
4.1 Types of Instability.....	56
4.2 Instability of Flow.....	57
4.21 Stuart's Instability Condition.....	60
4.22 Lock's Instability Condition.....	61
4.23 Rotating Cylinders.....	64
4.3 Convection.....	65
4.31 Exact Theory.....	68
4.4 The Darkness of Sunspots.....	74

5. Dynamo Theories	77
5.1 Statement of the Problem	77
5.2 Symmetric Fields	78
5.3 Elsasser's Theory	80
5.31 Eigenvalue Theory	83
5.4 Bullard's Theory	84
5.41 Results for the Earth's Field	87
5.5 The Mechanics of the Dynamo	88
5.6 Turbulent Motions	90
5.61 Compressibility	91
5.62 Turbulent Dissipation	92
5.7 Equipartition of Energy	93
5.71 The Vorticity Analogy	95
5.72 Conclusions	97
6. Ionized Gases	99
6.1 Effects of Molecular Structure	99
6.2 Currents in a Fully Ionized Gas	100
6.21 The Current Equation	102
6.3 The Conductivity	103
6.4 Partially Ionized Gases	105
6.5 Interstellar Fields	108
6.51 Dissipation in Hot Clouds	109
6.52 Dissipation in Cool Clouds	110
Index	113