

CONTENTS

PART I. INTRODUCTORY LECTURES	1
RELAXATION UNDER TOPOLOGICAL CONSTRAINTS	3
H.K. Moffatt	
1. Gravitational Relaxation	3
2. Magnetic Relaxation	7
3. Analogous Euler Flows	16
4. Knots and Links	23
5. Relaxation Using Artificial Dynamics	25
References	27
KNOT THEORY, JONES' POLYNOMIALS, INVARIANTS OF 3-MANIFOLDS, AND THE TOPOLOGICAL THEORY OF FLUID DYNAMICS	29
Kenneth C. Millett	
1. Knots and Links in 3-Space	29
2. The Bracket Polynomial	49
3. The 3-Manifold Invariants	56
References	60
TOPOLOGY OF KNOTS	65
Martin Scharlemann	
1. Knotting and Unknotting	65
2. Seifert Surfaces and Knot Genus	67
3. Winding, Wrapping, and Satellites	69
4. Band Sums and Connected Sums of Knots	71
5. Bridge Number and Curvature	75
6. Connections with Knot Energy	79
7. Entry into the Literature	81
References	81
STRETCHING AND ALIGNMENT IN GENERAL FLOW FIELDS: CLASSICAL TRAJECTORIES FROM REYNOLDS NUMBER ZERO TO INFINITY	83
M. Tabor	
1. Introduction	83
2. $Re \rightarrow 0$: Simple Deterministic Dynamical Systems	84
3. The Geometry of Trajectories: Stretching, Rotation and Linking	90
4. $Re \rightarrow \infty$: Stretching in Turbulent Flows	98

5. Alignment: The Interplay of Kinematics and Dynamics	102
References	108
FAST DYNAMO THEORY	111
S. Childress	
1. Kinematic Dynamos Slow and Fast	111
2. Examples of Fast Dynamos in Steady and Unsteady Flows	124
3. Analysis of the Perfectly Conducting Limit	135
References	145
 PART II. RELAXATION AND MINIMUM ENERGY STATES	 149
RELAXATION AND TOPOLOGY IN PLASMA EXPERIMENTS	151
J.B. Taylor	
TAYLOR'S RELAXATION IN AN UNBOUNDED DOMAIN OF SPACE	167
J.J. Aly	
FORCE-FREE MAGNETIC FIELDS WITH CONSTANT ALPHA	177
S.I. Vainshtein	
MINIMUM ENERGY MAGNETIC FIELDS WITH TOROIDAL TOPOLOGY	195
A.Y.K. Chui and H.K. Moffatt	
RESEARCH ANNOUNCEMENT ON THE "ENERGY" OF KNOTS	219
Michael H. Freedman and Zheng-Xu He	
 PART III. HELICITY, LINKAGE, AND FLOW TOPOLOGY	 223
THE HELICITY OF A KNOTTED VORTEX FILAMENT	225
R.L. Ricca and H.K. Moffatt	
A HEIRARCHY OF LINKING INTEGRALS	237
N.W. Evans and M.A. Berger	
BORROMEANISM AND BORDISM	249
Peter Akhmet'ev and Alexander Ruzmaikin	
TOPOLOGY OF STEADY FLUID FLOWS	265
Viktor L. Ginzburg and Boris Khesin	

PART IV. THE EULER EQUATIONS: EXTREMAL PROPERTIES AND FINITE TIME SINGULARITIES	273
EXTREMAL PROPERTIES AND HAMILTONIAN STRUCTURE OF OF THE EULER EQUATIONS	275
T.G. Shepherd	
BLOW UP IN AXISYMMETRIC EULER FLOWS	293
A. Pumir and E.D. Siggia	
IS THERE A FINITE-TIME SINGULARITY IN AXISYMMETRIC EULER FLOWS?	303
Xiaogang Wang and A. Bhattacharjee	
EVIDENCE FOR A SINGULARITY OF THE THREE-DIMENSIONAL INCOMPRESSIBLE EULER EQUATIONS	309
R.M. Kerr	
SINGULARITY FORMATION ON VORTEX SHEETS: THE RALEIGH-TAYLOR PROBLEM	337
M.S. Siegel	
PART V. VORTEX INTERACTIONS AND THE STRUCTURE OF TURBULENCE	351
2D TURBULENCE: NEW RESULTS FOR $Re \rightarrow \infty$	353
David C. Dritschel	
ON VORTEX RECONNECTION AND TURBULENCE	363
Olus N. Boratav, Richard B. Pelz and Norman J. Zabusky	
NEW ASPECTS OF VORTEX DYNAMICS: HELICAL WAVES, CORE DYNAMICS, VISCOUS HELICITY GENERATION, AND INTERACTION WITH TURBULENCE	377
Fazle Hussain and Mogens V. Melander	
INTERMITTENCY GROWTH IN 3D TURBULENCE	401
Y. Kimura	
DYNAMICAL MECHANISMS FOR INTERMITTENCY EFFECTS IN FULLY DEVELOPED TURBULENCE	415
Zhen-Su She	
THE MULTISPIRAL MODEL OF TURBULENCE AND INTERMITTENCY	427
J.C. Vassilicos	

MEASUREMENTS OF LOCAL SCALING OF TURBULENT VELOCITY FIELDS AT HIGH REYNOLDS NUMBERS	443
G.M. Zaslavsky, A.A. Chernikov, A.A. Praskovsky, M.Yu. Karyakin and D.A. Usikov	
ON THE DETERMINATION OF UNIVERSAL MULTIFRACTAL PARAMETERS IN TURBULENCE	463
D. Lavallée, S. Lovejoy, D. Schertzer and F. Schmitt	
PART VI. CHAOS, INSTABILITY AND DYNAMO THEORY	479
ANOMOLOUS TRANSPORT AND FRACTAL KINETICS	481
G.M. Zaslavsky	
KINEMATICAL INSTABILITY AND LINE-STRETCHING IN RELATION TO THE GEODESICS OF FLUID MOTION	493
T. Kambe, F. Nakamura and Y. Hattori	
THE BEHAVIOR OF ACTIVE AND PASSIVE PARTICLES IN A CHAOTIC FLOW	505
M.D. Dahleh	
CHAOS ASSOCIATED WITH FLUID INERTIA	517
K. Bajer and H.K. Moffatt	
INSTABILITY CRITERIA IN FLUID DYNAMICS	535
Susan Friedlander and Misha M. Vishik	
LOCALIZED INSTABILITIES IN FLUIDS	551
Alexander Lifschitz and Eliezer Hameiri	
KINEMATIC FAST DYNAMO ACTION IN A TIME-PERIODIC CHAOTIC FLOW	563
I. Klapper	
AN EXACT TURBULENT CLOSURE FOR THE HYDROMAG- NETIC DYNAMO	573
Hubert H. Shen	
AUTHOR INDEX	599
SUBJECT INDEX	603