Frances Bauer Octavio Betancourt Paul Garabedian

Magnetohydrodynamic Equilibrium and Stability of Stellarators



<u>Magnetohydrodynamic Equilibrium And Stability Of</u> <u>Stellarators</u>

Robert L May, Alan K Easton

Magnetohydrodynamic Equilibrium And Stability Of Stellarators:

Magnetohydrodynamic Equilibrium and Stability of Stellarators F. Bauer, O. Betancourt, P. Garabedian, 2012-12-06 In this book we describe in detail a numerical method to study the equilibrium and stability of a plasma confined by a strong magnetic field in toroidal geometry without two dimensional symmetry. The principal application is to stellarators which are currently of interest in thermonuclear fusion research Our mathematical model is based on the partial differential equations of ideal magnetohydrodynamics The main contribution is a computer code named BETA that is listed in the final chapter This work is the natural continuation of an investigation that was presented in an early volume of the Springer Series in Computational Physics of 3 It has been supported over a period of years by the U S Department of Energy under Contract DE AC02 76ER03077 with New York University We would like to express our gratitude to Dr Franz Herrnegger for the assistance he has given us with the preparation of the manuscript We are especially indebted to Connie Engle for the high quality of the final typescript New York F BAUER October 1983 O BETANCOURT P GARABEDIAN Contents 1 Introduction 1 2 Synopsis of the Method 3 1 Variational principle 3 2 Coordinate system 6 3 Finite Difference Scheme 8 1 Difference equations 8 2 Island structure 10 3 Accelerated iteration procedure 12 Nonlinear Stability 15 4 1 Second minimization 15 2 Test functions and convergence studies 17 3 Comparison with exact solutions 19 5 The Mercier Criterion 22 1 Local mode analysis 22 2 Computational method 23 Magnetohydrodynamic Equilibrium and Stability of Stellarators Felix Bauer, O. Betancourt, P. Garabedian, 2011-10-30 In this book we describe in detail a numerical method to study the equilibrium and stability of a plasma confined by a strong magnetic field in toroidal geometry without two dimensional symmetry The principal appli cation is to stellarators which are currently of interest in thermonuclear fusion research Our mathematical model is based on the partial differential equations of ideal magnetohydrodynamics. The main contribution is a computer code named BETA that is listed in the final chapter This work is the natural continuation of an investigation that was presented in an early volume of the Springer Series in Computational Physics of 3 It has been supported over a period of years by the U S Department of Energy under Contract DE AC02 76ER03077 with New York University We would like to express our gratitude to Dr Franz Herrnegger for the assistance he has given us with the preparation of the manuscript We are especially indebted to Connie Engle for the high quality of the final typescript New York F BAUER October 1983 O BETANCOURT P GARABEDIAN Contents 1 Introduction 1 2 Synopsis of the Method 3 1 Variational principle 3 2 Coordinate system 6 3 Finite Difference Scheme 8 1 Difference equations 8 2 Island structure 10 3 Accelerated iteration procedure 12 Nonlinear Stability 15 4 1 Second minimization 15 2 Test functions and convergence studies 17 3 Comparison with exact solutions 19 5 The Mercier Criterion 22 1 Local mode analysis 22 2 Computational method 23 Magnetohydrodynamic Equilibrium and Stability of Stellarators Frances Bauer, Octavio Betancourt, Paul Garabedian, 1984

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