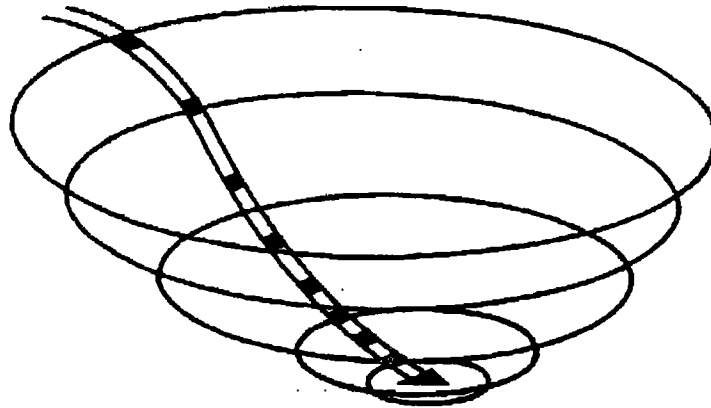


FORTRAN CALCULUS



SOFTWARE FOR MATHEMATICAL OPTIMIZATION

REFERENCE MANUAL



DIGITAL
CALCULUS
CORPORATION

© 1990 All Rights Reserved

Table of Contents

INTRODUCTION

1. The Calculus Environment

Environment Programs	1-1
Memory Organization	1-2
Macro Statements	1-4
Context Declaration Syntax	1-6
Computing and Data Management Syntax	1-10
Command Calls	1-16
Output Streams and Report Generation	1-17
Special Syntax Rules	1-23
Special Restrictions	1-23

2. Systems Analysis & Calculus Processes

Systems Analysis	2-1
Calculus Processes	2-20
Integration Processes	2-24
Optimization Processes	2-29
Combined Processes	2-33
The Process Model	2-36
Control of Calculus Processes	2-36

3. Elementary Operations & Utilities

Invoking Derivative Evaluation	3-2
Assignment of Derivatives to Variables	3-6
Printing Derivatives	3-8
Evaluating Definite Integrals	3-10
Dealing With Tabular Functions	3-16
Polynomial Regression (POLYREG)	3-16
Table Interpolation (TABLES and LOOKUP)	3-18
General Least Squares Data Fitting (FITxxx)	3-20
Surface Fitting (SFIT)	3-35
Minimax Polynomial Data Fitting (CHEBFIT)	3-36

Linear Algebra Operations	3-38
Array Assignment	3-38
Matrix Algebra Assignment	3-42
Utilities	3-44
Utility Functions	3-44
Utility Command Calls	3-45
4. General Algebraic Equations	
Implicit Equations	4-2
AJAX - Newton-Gauss Equations Solver	4-3
MARS - Newton-Householder Equations Solver	4-11
Inequality Constraints	4-13
Systems of Inequalities	4-14
Multiple Roots of Nonlinear Equations	4-16
5. Ordinary Differential Equations	
Non-Propagating Solvers	5-2
Solver JANUS	5-2
Solver MERCURY	5-7
Propagating Solvers	5-11
Solver ISIS	5-11
Solver JANISIS	5-12
The Integration Model	5-12
Higher Order Differential Equations	5-13
Implicit Differential Equations	5-15
Rational Function Extrapolation (RFE) Solvers	5-17
Solver NEPTUNE	5-18
Solver MERLIN	5-19
Solver GEMINI	5-19
Solvers for Limiting Integration	5-20
Solver MINERVA	5-21
Solver ATHENA	5-25
Solver PEGASUS	5-26
Guidelines for Selecting Solvers	5-27

6. Unconstrained Optimization

Solver HERA	6-1
Using Constrained Optimization Solvers	6-9
Optimization Hierarchies	6-10
Equality Constraints via Nested Equation Solving	6-11
Optimizing Differential Equations Models	6-16
ADS Solvers VESTA, DIANA, and SELENE	6-23

7. Constrained Optimization

Solver JOVE	7-4
Solver ZEUS	7-10
Solver THOR	7-11
Solver JUPITER	7-16
Solver HERCULES	7-19
ADS Constrained Optimization Solvers	7-29
Solver APOLLO	7-29
Solver ATLAS	7-34
Solver ODIN	7-37
Solver HELIOS	7-41
Solver CRONUS	7-44
Solvers DEMETER & CERES	7-48

8. Graphics Subsystem

Graph Synthesis Command Calls	8-2
Graph Production Command Calls	8-15
X-Y Plotting Applications	8-17
Contour Plotting Applications	8-34

Appendix A: Guidelines for Data Approximation