Solutions To Problems On The Newton Raphson Method

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Introduction to Quantitative Macroeconomics Using Julia - Petre Caraiani 2018-08-29 Introduction to Quantitative Macroeconomics Using Julia: From Basic to State-of-the-Art Computational Techniques facilitates access to fundamental techniques in computational and quantitative macroeconomics. It focuses on the recent and very promising software, Julia, which offers a MATLAB-like language at speeds comparable to C/Fortran, also discussing modeling challenges that make quantitative macroeconomics

dynamic, a key feature that few books on the topic include for macroeconomists who need the basic tools to build, solve and simulate macroeconomic models. This book neatly fills the gap between intermediate macroeconomic books and modern DSGE models used in research. Combines an introduction to Julia, with the specific needs of macroeconomic students who are interested in DSGE models and PhD students and researchers interested in building DSGE models Teaches fundamental techniques in quantitative macroeconomics by introducing theoretical elements of key macroeconomic models and their potential algorithmic implementations Exposes researchers working in macroeconomics to state-of-the-art computational techniques for simulating and solving DSGE models

Newton Methods for Nonlinear Problems - Peter Deuflhard 2011-09-18

This book deals with the efficient numerical solution of challenging nonlinear problems in science and engineering, both in finite dimension (algebraic systems) and in infinite dimension (ordinary and partial differential equations). Its focus is on local and global Newton methods for direct problems or Gauss-Newton methods for inverse problems. The term 'affine invariance' means that the presented algorithms and their convergence analysis are invariant under one out of four subclasses of affine transformations of the problem to be solved. Compared to traditional textbooks, the distinguishing affine invariance approach leads to shorter theorems and proofs and permits the construction of fully adaptive algorithms. Lots of numerical illustrations, comparison tables, and exercises make the text useful in computational mathematics classes. At the same time, the book opens many directions for possible future research.

Numerical Solution of Nonlinear Boundary Value Problems with Applications -

Milan Kubicek 2008-01-01
A survey of the development, analysis, and application of numerical techniques in solving nonlinear boundary value problems, this text presents numerical analysis as a working tool for physicists and engineers. Starting with a survey of accomplishments in the field, it explores initial and boundary value problems for ordinary differential equations, linear boundary value problems, and the numerical realization of parametric studies in nonlinear boundary value problems. The authors--Milan Kubicek, Professor at the Prague Institute of Chemical Technology, and Vladimir Hlavacek, Professor at the University of Buffalo--emphasize the description and straightforward application of numerical techniques rather than underlying theory. This approach reflects their extensive experience with the application of diverse numerical algorithms.

Automation of Finite Element Methods - Jože Korelc 2016-06-08
New finite elements are needed as well in research as in industry environments for thedevelopment of virtual prediction techniques. The design and implementation of novel finiteelements for specific purposes is a tedious and time consuming task, especially for nonlinearformulations. The automation of this process can help to speed up this processconsiderably since the generation of the final computer code can be accelerated by order ofseveral magnitudes.This book provides the reader with the required knowledge needed to employ modernautomatic tools like AceGen within solid mechanics in a successful way. It covers the rangefrom the theoretical background, algorithmic treatments to many different applications. Thebook is written for advanced students in the engineering field and for researchers ineducational and industrial environments.

Computational Solution of Nonlinear Systems of Equations - Eugene L.

Allgower 1990-04-03
Nonlinear equations arise in essentially every branch of modern science, engineering, and mathematics. However, in only a very few special cases is it possible to obtain useful solutions to nonlinear equations via analytical calculations. As a result, many scientists resort to computational methods. This book contains the proceedings of the Joint AMS-SIAM Summer Seminar, ``Computational Solution of Nonlinear Systems of Equations,'' held in July 1988 at Colorado State University. The aim of the book is to give a wide-ranging survey of essentially all of the methods which comprise currently active areas of research in the computational solution of systems of nonlinear equations. A number of ``entry-level'' survey papers were solicited, and a series of test problems has been collected in an appendix. Most of the articles are accessible to students who have had a course in numerical analysis.

Numerical Mathematics and Applications - J. Vignes 2014-06-28
Numerical Mathematics and Applications

EBOOK: Power System Analysis (SI units) - Grainger ; Stev 2016-02-16
EBOOK: Power System Analysis (SI units)

Nonlinear Finite Element Methods - Peter Wriggers 2008-09-24
Finite element methods have become ever more important to engineers as tools for design and optimization, now even for solving non-linear technological problems. However, several aspects must be considered for finite-element simulations which are specific for non-linear problems: These problems require the knowledge and the understanding of theoretical foundations and their finite-element discretization as well as algorithms for solving the non-linear equations. This book provides the reader with the required knowledge covering the complete field of finite element analyses in solid mechanics. It is written for

advanced students in engineering fields but serves also as an introduction into non-linear simulation for the practising engineer.

Numerical Solution of Elliptic Problems - Garrett Birkhoff 1984-01-01

A study of the art and science of solving elliptic problems numerically, with an emphasis on problems that have important scientific and engineering applications, and that are solvable at moderate cost on computing machines.

Solution of Large Scale Pipe Networks by Improved Mathematical Approaches - 1978

Problems of Nonlinear Deformation - E.I. Grigolyuk 2012-12-06

Interest in nonlinear problems in mechanics has been revived and intensified by the capacity of digital computers. Consequently, a question offundamental importance is the development of solution procedures which can be applied to a large class of problems. Nonlinear problems with a parameter constitute one such class. An important aspect of these problems is, as a rule, a question of the variation of the solution when the parameter is varied. Hence, the method of continuing the solution with respect to a parameter is a natural and, to a certain degree, universal tool for analysis. This book includes details of practical problems and the results of applying this method to a certain class of nonlinear problems in the field of deformable solid mechanics. In the Introduction, two forms of the method are presented, namely continu ous continuation, based on the integration of a Cauchy problem with respect to a parameter using explicit schemes, and discrete continuation, implementing step wise processes with respect to a parameter with the iterative improvement of the solution at each step. Difficulties which arise in continuing the solution in the neighbourhood of singular points are discussed and the problem of choosing the

continuation parameter is formulated.

Numerical Solutions of Boundary Value Problems of Non-linear Differential Equations - Sujaul Chowdhury 2021-10-25

The book presents in comprehensive detail numerical solutions to boundary value problems of a number of non-linear differential equations. Replacing derivatives by finite difference approximations in these differential equations leads to a system of non-linear algebraic equations which we have solved using Newton's iterative method. In each case, we have also obtained Euler solutions and ascertained that the iterations converge to Euler solutions. We find that, except for the boundary values, initial values of the 1st iteration need not be anything close to the final convergent values of the numerical solution. Programs in Mathematica 6.0 were written to obtain the numerical solutions.

Modern Computational Methods - Herbert Koenig 2019-05-20

This book is an introduction to computational mechanics, proceeding from basic computational tools to advanced computational procedures and applications. Emphasis is placed on the numerical techniques and how they form the bases for algorithms. Numerous worked examples in structural mechanics, heat transfer, fluid flow, and biomechanics are given with the numerical codes to illustrate how the methods are applied. A concluding section addresses advanced applications in such areas as finite volume methods and biomechanics.

A Combined Newton-Raphson and Gradient Parameter Correction Technique for Solution of Optimal-control Problems - 1968

An efficient solution procedure for elastohydrodynamic contact problems considering structural dynamics - Schmidt, Jan Henrik 2019-01-14

Numerical Derivatives and Nonlinear Analysis - Harriet Kagiwada 2013-03-08

For many years it has been an article of faith of numerical analysts that the evaluation of derivatives of complicated functions should be avoided. Derivatives were evaluated using finite differences or, more recently, using symbolic manipulation packages. The first has the disadvantage of limited accuracy. The second has disadvantages of being expensive and requiring considerable computer memory. The recent developments described in this text allow the evaluation of derivatives using simple automatic derivative evaluation subroutines pro grammed in FORTRAN or BASIC. These subroutines can even be programmed on a personal computer. The concept for the evaluation of the derivatives was originally developed by Wengert over 20 years ago. Significant im provements have been made in Wengert's method and are utilized in this text. The purpose of this text is to familiarize computer users with a simple and practical method for obtaining the partial derivatives of complicated mathematical expressions. The text illustrates the use of automatic deriva tive evaluation subroutines to solve a wide range of nonlinear least-squares, optimal control, system identification, two-point boundary value problems, and integral equations. The numerical values of the derivatives are evalu~ ated exactly, except for roundoff, using simple FORTRAN or BASIC sub routines. These derivatives are derived automatically behind the scenes, from the equivalent of analytical expressions, without any effort from the user. The use of costly software packages is not required.

Modern Power System Analysis - Turan Gonen 2016-04-19

Most textbooks that deal with the power analysis of electrical engineering power systems focus on generation or distribution systems. Filling a

gap in the literature, Modern Power System Analysis, Second Edition introduces readers to electric power systems, with an emphasis on key topics in modern power transmission engineering. Throughout, the boo

Numerical Solution of Nonlinear Elliptic Problems Via Preconditioning Operators - István Faragó 2002

Numerical Solution of Nonlinear Elliptic Problems Via Preconditioning Operators - Theory & Applications

Control of Distributed Parameter Systems 1989 - M. Amouroux 2014-06-28

This volume presents state-of-the-art reports on the theory, and current and future applications of control of distributed parameter systems. The papers cover the progress not only in traditional methodology and pure research in control theory, but also the rapid growth of its importance for different applications. This title will be of interest to researchers working in the areas of mathematics, automatic control, computer science and engineering.

Mixed-Signal Methodology Guide - Jess Chen 2012

This book, the Mixed-signal Methodology Guide: Advanced Methodology for AMS IP and SoC Design, Verification, and Implementation provides a broad overview of the design, verification and implementation methodologies required for today's mixed-signal designs. The book covers mixed-signal design trends and challenges, abstraction of analog using behavioral models, assertion-based metric-driven verification methodology applied on analog and mixed-signal and verification of low power intent in mixed-signal design. It also describes methodology for physical implementation in context of concurrent mixed-signal design and for handling advanced node physical effects. The book contains many practical examples of models and techniques. The authors believe it should serve as a reference to many analog,

digital and mixed-signal designers, verification, physical implementation engineers and managers in their pursuit of information for a better methodology required to address the challenges of modern mixed-signal design.

Nanoelectronic Coupled Problems Solutions - E. Jan W. ter Maten 2019-11-06

Designs in nanoelectronics often lead to challenging simulation problems and include strong feedback couplings. Industry demands provisions for variability in order to guarantee quality and yield. It also requires the incorporation of higher abstraction levels to allow for system simulation in order to shorten the design cycles, while at the same time preserving accuracy. The methods developed here promote a methodology for circuit-and-system-level modelling and simulation based on best practice rules, which are used to deal with coupled electromagnetic field-circuit-heat problems, as well as coupled electro-thermal-stress problems that emerge in nanoelectronic designs. This book covers: (1) advanced monolithic/multirate/co-simulation techniques, which are combined with envelope/wavelet approaches to create efficient and robust simulation techniques for strongly coupled systems that exploit the different dynamics of sub-systems within multiphysics problems, and which allow designers to predict reliability and ageing; (2) new generalized techniques in Uncertainty Quantification (UQ) for coupled problems to include a variability capability such that robust design and optimization, worst case analysis, and yield estimation with tiny failure probabilities are possible (including large deviations like 6-sigma); (3) enhanced sparse, parametric Model Order Reduction techniques with a posteriori error estimation for coupled problems and for UQ to reduce the complexity of the sub-systems while ensuring that the operational and coupling parameters can still be varied

and that the reduced models offer higher abstraction levels that can be efficiently simulated. All the new algorithms produced were implemented, transferred and tested by the EDA vendor MAGWEL. Validation was conducted on industrial designs provided by end-users from the semiconductor industry, who shared their feedback, contributed to the measurements, and supplied both material data and process data. In closing, a thorough comparison to measurements on real devices was made in order to demonstrate the algorithms' industrial applicability.

Iterative Solution of Nonlinear Equations in Several Variables - J. M. Ortega 2014-05-10

Computer Science and Applied Mathematics: Iterative Solution of Nonlinear Equations in Several Variables presents a survey of the basic theoretical results about nonlinear equations in n dimensions and analysis of the major iterative methods for their numerical solution. This book discusses the gradient mappings and minimization, contractions and the continuation property, and degree of a mapping. The general iterative and minimization methods, rates of convergence, and one-step stationary and multistep methods are also elaborated. This text likewise covers the contractions and nonlinear majorants, convergence under partial ordering, and convergence of minimization methods. This publication is a good reference for specialists and readers with an extensive functional analysis background.

Error Estimates for Advanced Galerkin Methods - Marcus Olavi Rüter 2019-11-07

This monograph provides a compendium of established and novel error estimation procedures applied in the field of Computational Mechanics. It also includes detailed derivations of these procedures to offer insights into the concepts used to control the errors obtained from employing Galerkin methods in finite and linearized

hyperelasticity. The Galerkin methods introduced are considered advanced methods because they remedy certain shortcomings of the well-established finite element method, which is the archetypal Galerkin (mesh-based) method. In particular, this monograph focuses on the systematical derivation of the shape functions used to construct both Galerkin mesh-based and meshfree methods. The mesh-based methods considered are the (conventional) displacement-based, (dual-)mixed, smoothed, and extended finite element methods. In addition, it introduces the element-free Galerkin and reproducing kernel particle methods as representatives of a class of Galerkin meshfree methods. Including illustrative numerical examples relevant to engineering with an emphasis on elastic fracture mechanics problems, this monograph is intended for students, researchers, and practitioners aiming to increase the reliability of their numerical simulations and wanting to better grasp the concepts of Galerkin methods and associated error estimation procedures.

Handbook of Differential Equations - Daniel Zwillinger 1998

This book compiles the most widely applicable methods for solving and approximating differential equations. as well as numerous examples showing the methods use. Topics include ordinary differential equations, symplectic integration of differential equations, and the use of wavelets when numerically solving differential equations. For nearly every technique, the book provides: The types of equations to which the method is applicable The idea behind the method The procedure for carrying out the method At least one simple example of the method Any cautions that should be exercised Notes for more advanced users References to the literature for more discussion or more examples, including pointers to electronic resources, such as

URLs

Structural Dynamic Systems Computational Techniques and Optimization - Cornelius T. Leondes 1999-01-27

The finite element, an approximation method for solving differential equations of mathematical physics, is a highly effective technique in the analysis and design, or synthesis, of structural dynamic systems. Starting from the system differential equations and its boundary conditions, what is referred to as a weak form of the problem (elaborated in the text) is developed in a variational sense. This variational statement is used to define elemental properties that may be written as matrices and vectors as well as to identify primary and secondary boundaries and all possible boundary conditions. Specific equilibrium problems are also solved. This book clearly reveals the effectiveness and great significance of the finite element method available and the essential role it will play in the future as further development occurs.

Boundary Value Problems for Engineers - Ali Ümit Keskin 2019-06-19

This book is designed to supplement standard texts and teaching material in the areas of differential equations in engineering such as in Electrical ,Mechanical and Biomedical engineering. Emphasis is placed on the Boundary Value Problems that are often met in these fields.This keeps the the spectrum of the book rather focussed .The book has basically emerged from the need in the authors lectures on “Advanced Numerical Methods in Biomedical Engineering” at Yeditepe University and it is aimed to assist the students in solving general and application specific problems in Science and Engineering at upper-undergraduate and graduate level.Majority of the problems given in this book are self-contained and have varying levels of difficulty to encourage the student. Problems that deal with MATLAB simulations are particularly intended to guide

the student to understand the nature and demystify theoretical aspects of these problems. Relevant references are included at the end of each chapter. Here one will also find large number of software that supplements this book in the form of MATLAB script (.m files). The name of the files used for the solution of a problem are indicated at the end of each corresponding problem statement.There are also some exercises left to students as homework assignments in the book. An outstanding feature of the book is the large number and variety of the solved problems that are included in it. Some of these problems can be found relatively simple, while others are more challenging and used for research projects. All solutions to the problems and script files included in the book have been tested using recent MATLAB software.The features and the content of this book will be most useful to the students studying in Engineering fields, at different levels of their education (upper undergraduate-graduate).

Applications of Nonlinear Programming to Optimization and Control - H. E. Rauch 2014-05-23

Applications of Nonlinear Programming to Optimization and Control is a collection of papers presented at the Fourth International Federation of Automatic Control Workshop by the same title, held in San Francisco, California on June 20-21, 1983. This workshop aims to exchange information on the applications of optimization and nonlinear programming techniques to real-life control problems, to investigate ideas that arise from these exchanges, and to look for advances in nonlinear programming that are useful in solving control problems. This book is divided into 16 chapters. It covers a wide range of related topics, starting with computer-aided-design of practical control systems, continuing through advanced work on quasi-Newton methods and gradient restoration algorithms. Other chapters provide specific examples,

which apply these methods to representative problems. The remaining chapters present examples, including trajectory optimization, optimal design of a structure for a satellite, identification of hovercraft characteristics, determination of optimal electricity generation, and optimal automatic transmission for road vehicles. This book is of value to computer scientists and mathematicians.

Calculus Problem Solutions with MATLAB® - Dingyü Xue 2020-03-23

This book focuses on solving practical problems in calculus with MATLAB. Descriptions and sketching of functions and sequences are introduced first, followed by the analytical solutions of limit, differentiation, integral and function approximation problems of univariate and multivariate functions. Advanced topics such as numerical differentiations and integrals, integral transforms as well as fractional calculus are also covered in the book.

Stability Analysis of Plates and Shells - 1998

Numerical Solution of Boundary Value Problems for Ordinary Differential Equations - Uri M. Ascher 1994-12-01

This book is the most comprehensive, up-to-date account of the popular numerical methods for solving boundary value problems in ordinary differential equations. It aims at a thorough understanding of the field by giving an in-depth analysis of the numerical methods by using decoupling principles. Numerous exercises and real-world examples are used throughout to demonstrate the methods and the theory. Although first published in 1988, this republication remains the most comprehensive theoretical coverage of the subject matter, not available elsewhere in one volume. Many problems, arising in a wide variety of application areas, give rise to mathematical models which form boundary value problems for ordinary differential

equations. These problems rarely have a closed form solution, and computer simulation is typically used to obtain their approximate solution. This book discusses methods to carry out such computer simulations in a robust, efficient, and reliable manner.

Numerical Methods, 4th - J. Douglas Faires 2012-04-23

NUMERICAL METHODS, Fourth Edition emphasizes the intelligent application of approximation techniques to the type of problems that commonly occur in engineering and the physical sciences. Readers learn why the numerical methods work, what kinds of errors to expect, and when an application might lead to difficulties. The authors also provide information about the availability of high-quality software for numerical approximation routines. The techniques are the same as those covered in the authors' top-selling Numerical Analysis text, but this text provides an overview for students who need to know the methods without having to perform the analysis. This concise approach still includes mathematical justifications, but only when they are necessary to understand the methods. The emphasis is placed on describing each technique from an implementation standpoint, and on convincing the reader that the method is reasonable both mathematically and computationally. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Numerical Methods - M. K. Jain 2007

Is An Outline Series Containing Brief Text Of Numerical Solution Of Transcendental And Polynomial Equations, System Of Linear Algebraic Equations And Eigenvalue Problems, Interpolation And Approximation, Differentiation And Integration, Ordinary Differential Equations And Complete Solutions To About 300 Problems. Most Of These Problems Are Given As Unsolved Problems In The

Authors Earlier Book. User Friendly Turbo Pascal Programs For Commonly Used Numerical Methods Are Given In The Appendix. This Book Can Be Used As A Text/Help Book Both By Teachers And Students.

Problems & Solutions in Scientific Computing - Willi-Hans Steeb 2004

Scientific computing is a collection of tools, techniques and theories required to develop and solve mathematical models in science and engineering on a computer. This timely book provides the various skills and techniques needed in scientific computing. The topics range in difficulty from elementary to advanced, and all the latest fields in scientific computing are covered such as matrices, numerical analysis, neural networks, genetic algorithms, etc.Presented in the format of problems and detailed solutions, important concepts and techniques are introduced and developed. Many problems include software simulations. Algorithms have detailed implementations in C++ or Java. This book will prove to be invaluable not only to students and research workers in the fields of scientific computing, but also to teachers of this subject who will find this text useful as a supplement.The topics discussed in this book are part of the e-learning and distance learning courses conducted by the International School of Scientific Computing, South Africa.

Mechanisms - Jaime Gallardo-Alvarado 2022-08-01

Theory of mechanisms is an applied science of mechanics that studies the relationship between geometry, mobility, topology, and relative motion between rigid bodies connected by geometric forms. Recently, knowledge in kinematics and mechanisms has considerably increased, causing a renovation in the methods of kinematic analysis. With the progress of the algebras of kinematics and the mathematical methods used in the optimal solution of polynomial equations, it has become possible to formulate

and elegantly solve problems. Mechanisms: Kinematic Analysis and Applications in Robotics provides an updated approach to kinematic analysis methods and a review of the mobility criteria most used in planar and spatial mechanisms. Applications in the kinematic analysis of robot manipulators complement the material presented in the book, growing in importance when one recognizes that kinematics is a basic area in the control and modeling of robot manipulators. Presents an organized review of general mathematical methods and classical concepts of the theory of mechanisms Introduces methods approaching time derivatives of arbitrary vectors employing general approaches based on the vector angular velocity concept introduced by Kane and Levinson Proposes a strategic approach not only in acceleration analysis but also to jerk analysis in an easy to understand and systematic way Explains kinematic analysis of serial and parallel manipulators by means of the theory of screws

A Combined Newton-Raphson and Gradient Parameter Correction Technique for Solution of Optimal-control Problems - Ernest S. Armstrong 1968

A parameter correction technique is developed to solve a boundary-value problem which frequently occurs in optimal-control theory. It is assumed that an indirect optimal-control method has been applied to a controllable dynamic system with a two-point boundary-value problem resulting such that the boundary conditions take the form of a set of unknown parameters to be determined to meet an equal number of terminal conditions. The optimal-control law is a piecewise continuous function with discontinuities occurring only at the zeros of certain continuous functions. A procedure is developed to improve upon an assumed set of parameters so that, by repetitive use of a correction formula, a monotonic decreasing sequence of values

of a positive definitive function that measures the terminal errors is produced. The direction of the correction vector is found to lie between the directions given by the gradient and the Newton-Raphson procedures. Integral equations are derived for influence matrices that describe the effect of a change in the parameters on the terminal conditions. The procedure is successfully applied to the determination of both planar and nonplanar fuel-optimal trajectories for a space vehicle which is launched from the surface of the moon and required to rendezvous with a space vehicle in a circular orbit.

Biomechanics of Soft Tissue in Cardiovascular Systems - Gerhard A. Holzapfel 2014-05-04

The book is written by leading experts in the field presenting an up-to-date view of the subject matter in a didactically sound manner. It presents a review of the current knowledge of the behaviour of soft tissues in the cardiovascular system under mechanical loads, and the importance of constitutive laws in understanding the underlying mechanics is highlighted. Cells are also described together with arteries, tendons and ligaments, heart, and other biological tissues of current research interest in biomechanics. This includes experimental, continuum mechanical and computational perspectives, with the emphasis on nonlinear behaviour, and the simulation of mechanical procedures such as balloon angioplasty.

Formulation and Numerical Solution of Quantum Control Problems - Alfio Borzi 2017-07-06

This book provides an introduction to representative nonrelativistic quantum control problems and their theoretical analysis and solution via modern computational techniques. The quantum theory framework is based on the Schr?dinger picture, and the optimization theory, which focuses on functional spaces, is

based on the Lagrange formalism. The computational techniques represent recent developments that have resulted from combining modern numerical techniques for quantum evolutionary equations with sophisticated optimization schemes. Both finite and infinite-dimensional models are discussed, including the three-level Lambda system arising in quantum optics, multispin systems in NMR, a charged particle in a well potential, Bose?Einstein condensates, multiparticle spin systems, and multiparticle models in the time-dependent density functional framework. This self-contained book covers the formulation, analysis, and numerical solution of quantum control problems and bridges scientific computing, optimal control and exact controllability, optimization with differential models, and the sciences and engineering that require quantum control methods. ??

Modeling, Analysis and Optimization of Process and Energy Systems - F. Carl Knopf 2011-12-14

Energy costs impact the profitability of virtually all industrial processes. Stressing how plants use power, and how that power is actually generated, this book provides a clear and simple way to understand the energy usage in various processes, as well as methods for optimizing these processes using practical hands-on simulations and a unique approach that details solved problems utilizing actual plant data. Invaluable information offers a complete energy-saving approach essential for both the chemical and mechanical engineering curricula, as well as for practicing engineers.

Scientific and Technical Aerospace Reports - 1982

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

NASA Conference Publication -

1980