Entropy Problems And Solutions

Operator splitting (or the fractional steps method) is a very common tool to analyze nonlinear partial differential equations both numerically and analytically. By applying operator splitting to a complicated model one can often split it into simpler problems that can be analyzed separately. In this book one studies operator splitting for a family of nonlinear evolution equations, including hyperbolic conservation laws and degenerate convection-diffusion equations. Common for these equations is the prevalence of rough, or non-smooth, solutions, e.g., shocks. Rigorous analysis is presented, showing that both semi-discrete and fully discrete splitting methods converge. For conservation laws, sharp error estimates are provided and for convection-diffusion equations one discusses a priori and a posteriori correction of entropy errors introduced by the splitting. Numerical methods include finite difference and finite volume methods as well as front tacking. The theory is illustrated by numerous examples. There is a dedicated web page that provides MATLAB codes for many of the examples. The book is suitable for graduate students and researchers in pure and applied mathematics, physics, and engineering.

Volume 5.

A companion book to the textbook The Exergy Method of Thermal Plant Analysis. This Companion Book presents model solutions to the questions taken from Appendix G of the main textbook. Since the Exergy Method is a relatively new area of Applied Thermodynamics it was thought that the presentation of model solutions of problems of various types would be of some help both to teachers and to self-teaching students. The advantages of the use of exergy analysis were demonstrated by pointing out and quantifying thermodynamic losses of various plant components and plant configurations. These were discussed at the end of the solutions under Comments. It is hoped that this will give students a deeper understanding of the nature of irreversibilities of various kinds and their effect on plant performance. Dr Tadeusz J. Kotas joined the Department of Mechanical Engineering of Queen Mary College as a member of teaching staff in 1957. His main areas of interest were Mechanics of Fluids and Applied Thermodynamics, obtaining a PhD degree for his work in the former subject. His work in the latter subject focused on the Exergy Method, contributing to its development through his research and publications and to its dissemination through courses which he ran in Britain and in a number of European countries for practicing engineers and academics.

This volume contains the text of the twenty-five papers presented at two workshops entitled Maximum-Entropy and Bayesian Methods in Applied Statistics, which were held at the University of Wyoming from June 8 to 10, 1981, and from August 9 to 11, 1982. The workshops were organized to bring together researchers from different fields to critically examine maxi mum-entropy and Bayesian methods in science, engineering, medicine, oceanography, economics, and other disciplines. An effort was made to maintain an informal environment where ideas could be easily ~xchanged. That the workshops were at least partially successful is borne out by the fact that there have been two succeeding workshops, and the upcoming Fifth Workshop promises to be the largest of all. These workshops and their proceedings could not have been brought to their final form without the substantial help of a number of people. The support of David Hofmann, the past chairman, and Glen Rebka, Jr. , the present chairman of the Physics Department of the University of Wyoming, has been strong and essential. Glen has taken a special interest in seeing that the proceedings have received the support required for their comple tion. The financial support of the Office of University Research Funds, University of Wyoming, is gratefully acknowledged. The secretarial staff, in particular Evelyn Haskell, Janice Gasaway, and Marce Mitchum, of the University of Wyoming Physics Department has contributed a great number of hours in helping

C. Ray Smith organize and direct the workshops.

Publisher Description

This book is the first of its kind to provide a large collection of bioinformatics problems with accompanying solutions. Notably, the problem set includes all of the problems offered in Biological Sequence Analysis (BSA), by Durbin et al., widely adopted as a required text for bioinformatics courses at leading universities worldwide. Although many of the problems included in BSA as exercises for its readers have been repeatedly used for homework and tests, no detailed solutions for the problems were available. Bioinformatics instructors had therefore frequently expressed a need for fully worked solutions and a larger set of problems for use on courses. This book provides just that: following the same structure as BSA and significantly extending the set of workable problems, it will facilitate a better understanding of the contents of the chapters in BSA and will help its readers develop problem-solving skills that are vitally important for conducting successful research in the growing field of bioinformatics. All of the material has been class-tested by the authors at Georgia Tech, where the first ever M.Sc. degree program in Bioinformatics was held.

This volume has its origin in the Fifth, Sixth and Seventh Workshops on "Maximum-Entropy and Bayesian Methods in Applied Statistics", held at the University of Wyoming, August 5-8, 1985, and at Seattle University, August 5-8, 1986, and August 4-7, 1987. It was anticipated that the proceedings of these workshops would be combined, so most of the papers were not collected until after the seventh workshop. Because most of the papers in this volume are in the nature of advancing theory or solving specific problems, as opposed to status reports, it is believed that the contents of this volume will be of lasting interest to the Bayesian community. The workshop was organized to bring together researchers from different fields to critically examine maximum-entropy and Bayesian methods in science and engineering as well as other disciplines. Some of the papers were chosen specifically to kindle interest in new areas that may offer new tools or insight to the reader or to stimulate work on pressing problems that appear to be ideally suited to the maximum-entropy or Bayesian method. These workshops and their proceedings could not have been brought to their final form without the support or help of a number of people.

CONTENIDO: Finite-dimensional Hilbert Spaces - Qubits - Kronecker product and tensor product - Matrix properties - Density operators - Partial trace - Unitary transforms and quantum gates - Entropy - Measurement - Entanglement - Bell inequality - Teleportation - Cloning - Quantum algorithms - Quantum error correction - Quantum cryptography - Infinite-dimensional Hilbert Spaces - Harmonic oscillator and Bose operators - Coherent states - Squeezed states - Entanglement - Swapping and cloning - Hamilton operators.

This is the most authoritative and accessible single-volume reference book on applied mathematics. Featuring numerous entries by leading experts and organized thematically, it introduces readers to applied mathematics and its uses; explains key concepts; describes important equations, laws, and functions; looks at exciting areas of research; covers modeling and simulation; explores areas of application; and more. Modeled on the popular Princeton Companion to Mathematics, this volume is an indispensable resource for undergraduate and graduate students, researchers, and practitioners in other disciplines seeking a user-friendly reference book on applied mathematics. Features nearly 200 entries organized thematically and written by an international team of distinguished contributors Presents the major ideas and branches of applied mathematics in a clear and accessible way Explains important mathematical concepts, methods, equations, and

applications Introduces the language of applied mathematics and the goals of applied mathematical research Gives a wide range of examples of mathematical modeling Covers continuum mechanics, dynamical systems, numerical analysis, discrete and combinatorial mathematics, mathematical physics, and much more Explores the connections between applied mathematics and other disciplines Includes suggestions for further reading, cross-references, and a comprehensive index

We define a new notion of entropy for operators on Fock spaces and positive multi-Toeplitz kernels on free semigroups. This is studied in connection with factorization theorems for (e.g., multi-Toeplitz, multi-analytic, etc.) operators on Fock spaces. These results lead to entropy inequalities and entropy formulas for positive multi-Toeplitz kernels on free semigroups (resp. multi-analytic operators) and consequences concerning the extreme points of the unit ball of the noncommutative analytic Toeplitz algebra F_n^∞.We obtain several geometric characterizations of the central intertwining lifting, a maximal principle, and a permanence principle for the noncommutative commutant lifting theorem. Under certain natural conditions, we find explicit forms for the maximal entropy solution of this multivariable commutant lifting theorem. All these results are used to solve maximal entropy interpolation problems in several variables. We obtain explicit forms for the maximal entropy solution (as well as its entropy) of the Sarason, Caratheodory-Schur, and Nevanlinna-Pick type interpolation problems for the noncommutative (resp. commutative) analytic Toeplitz algebra F_n^∞ (resp. W_n^∞) and their tensor products with $B({\mathcal H}, {\mathcal K})$. In particular, we provide explicit forms for the maximal entropy solutions of several interpolation problems on the unit ball of $\mathbb{C}^n$.

Entropy optimization is a useful combination of classical engineering theory (entropy) with mathematical optimization. The resulting entropy optimization models have proved their usefulness with successful applications in areas such as image reconstruction, pattern recognition, statistical inference, queuing theory, spectral analysis, statistical mechanics, transportation planning, urban and regional planning, input-output analysis, portfolio investment, information analysis, and linear and nonlinear programming. While entropy optimization has been used in different fields, a good number of applicable solution methods have been loosely constructed without sufficient mathematical treatment. A systematic presentation with proper mathematical treatment of this material is needed by practitioners and researchers alike in all application areas. The purpose of this book is to meet this need. Entropy Optimization and Mathematical Programming offers perspectives that meet the needs of diverse user communities so that the users can apply entropy optimization techniques with complete comfort and ease. With this consideration, the authors focus on the entropy optimization problems in finite dimensional Euclidean space such that only some basic familiarity with optimization is required of the reader.

The last two decades have witnessed an enormous growth with regard to ap plications of information theoretic framework in areas of physical, biological, engineering and even social sciences. In particular, growth has been spectac ular in the field of information technology,soft computing,nonlinear systems and molecular biology. Claude Shannon in 1948 laid the foundation of the field of information theory in the context of communication theory. It is in deed remarkable that his framework is as relevant today as was when he 1 proposed it. Shannon died on Feb 24, 2001. Arun Netravali observes "As if assuming that inexpensive, high-speed processing would come to pass, Shan non figured out the upper limits on communication rates. First in telephone channels, then in optical communications, and now in wireless, Shannon has had the utmost value in defining the engineering limits we face". Shannon introduced the concept of entropy. The notable feature of the entropy frame work is that it enables quantification of uncertainty present in a system. In many realistic situations one is confronted only with partial or incomplete information in the form of moment, or bounds on these values etc. ; and it is then required to construct a probabilistic model from this partial information. In such situations, the principle of maximum entropy provides a rational ba sis for constructing a probabilistic model. It is thus necessary and important to keep track of advances in the applications of maximum entropy principle to ever expanding areas of knowledge.

This manual contains detailed solutions of slightly more than half of the end of chapter problems in The Dynamics of Heat. The numbers of the problems includ ed here are listed on the following page. A friend who knows me well noticed that I have included only those problems which I could actually solve myself. Also, to make things more interesting, I have built random errors into the solutions. If you find any of them, please let me know. Also, if you have different ways of solving a problem, I would be happy to hear from you. Any feedback, also on the book in general, would be greatly appreciated. There is an Errata sheet for the first printing of The Dynamics of Heat. By the time you read this, it should be available on the Internet for you to download. A reference to the URL of the sheet can be found in the announcement of my book on Springer's WWWpages (www.springer-ny.com). Winterthur, 1996 Hans Fuchs vi Numbers of Problems Solved Prologue 1,2,4,5,6,8, 12, 13, 17, 19,23,25,27,30,32,33,34,38,39,40,42,44,47, 49,50,53,55,60,61,62 Chapter 1 2,4,5,8,9,11,13,15, 16, 17, 18,20,21,24,26,27,29,31,33,34,37,39,41, 42,44,45,47,49,51,53,55,57,58,60,62 Chapter 2 1,3,5,6,7,9,10,12,14,15,16,17,19,20,22,23,24,26,27, 29, 30, 32, 33, 36,37,38,41,42,46,47,49 Interlude 2,3,4,5,6,8,10,11,12,13, 18, 19,20,21,23,24,28 Chapter 3 2,4,6,8,10,12,15,16,17,18,22,24,25,28,30,31,35,36 Chapter 4 1,2,4,6,8,9, 11, 12, 13, 15, 18,20,21,22,25,27,28,29,30,31,33,34,35, 39,40,43,44,46 Epilogue 1, 2, 11 PROLOGUE Solutions of Selected Problems 2 PROLOGUE: Problem 1 Calculate the hydraulic capacitance of a glass tube used in a mercury pressure gauge. The inner diameter of the tube is 8.0 mm.

The aim of the book is to cover the three fundamental aspects of research in equilibrium problems: the statement

problem and its formulation using mainly variational methods, its theoretical solution by means of classical and new variational tools, the calculus of solutions and applications in concrete cases. The book shows how many equilibrium problems follow a general law (the so-called user equilibrium condition). Such law allows us to express the problem in terms of variational inequalities. Variational inequalities provide a powerful methodology, by which existence and calculation of the solution can be obtained.

This book takes the topic of H-infinity control as a point of departure, and pursues an improved controller design suggested in the mainstream of robust control. Using stochastic methods, the book is important to the circuits and systems community, alongside researchers in networking systems, operator theory and linear multivariable control.

This book is devoted to the presentation of some flow problems in porous media having relevant industrial applications. The main topics covered are: the manufacturing of composite materials, the espresso coffee brewing process, the filtration of liquids through diapers, various questions about flow problems in oil reservoirs and the theory of homogenization. The aim is to show that filtration problems arising in very practical industrial context exhibit interesting and highly nontrivial mathematical aspects. Thus the style of the book is mathematically rigorous, but specifically oriented towards applications, so that it is intended for both applied mathematicians and researchers in various areas of technological interest. The reader is required to have a good knowledge of the classical theory of PDE and basic functional analysis.

The Twelfth International Workshop on Maximum Entropy and Bayesian Methods in Sciences and Engineering (MaxEnt 92) was held in Paris, France, at the Centre National de la Recherche Scientifique (CNRS), July 19-24, 1992. It is important to note that, since its creation in 1980 by some of the researchers of the physics department at the Wyoming University in Laramie, this was the second time that it took place in Europe, the first time was in 1988 in Cambridge. The two specificities of MaxEnt workshops are their spontaneous and informal charac ters which give the participants the possibility to discuss easily and to make very fruitful scientific and friendship relations among each others. This year's organizers had fixed two main objectives: i) to have more participants from the European countries, and ii) to give special interest to maximum entropy and Bayesian methods in signal and image processing. We are happy to see that we achieved these objectives: i) we had about 100 participants with more than 50 per cent from the European coun tries, ii) we received many papers in the signal and image processing subjects and we could dedicate a full day of the workshop to the image modelling, restoration and recon struction problems.

Quantum computing and quantum information are two of the fastest growing and most exciting research fields in physics. Entanglement, teleportation and the possibility of using the non-local behavior of quantum mechanics to factor integers in random polynomial time have also added to this new interest. This book presents a huge collection of problems in quantum computing and quantum information together with their detailed solutions, which will prove to be invaluable to students as well as researchers in

these fields. Each chapter gives a comprehensive introduction to the topics. All the important concepts and areas such as quantum gates and quantum circuits, product Hilbert spaces, entanglement and entanglement measures, teleportation, Bell states, Bell measurement, Bell inequality, Schmidt decomposition, quantum Fourier transform, magic gate, von Neumann entropy, quantum cryptography, quantum error corrections, quantum games, number states and Bose operators, coherent states, squeezed states, Gaussian states, coherent Bell states, POVM measurement, quantum optics networks, beam splitter, phase shifter and Kerr Hamilton operator are included. A chapter on quantum channels has also been added. Furthermore a chapter on boolean functions and quantum gates with mapping bits to qubits is included. The topics range in difficulty from elementary to advanced. Almost all problems are solved in detail and most of the problems are self-contained. Each chapter also contains supplementary problems to challenge the reader. Programming problems with Maxima and SymbolicC++ implementations are also provided.

This volume has its origin in the third ·Workshop on Maximum-Entropy and Bayesian Methods in Applied Statistics,· held at the University of Wyoming, August 1 to 4, 1983. It was anticipated that the proceedings of this workshop could not be prepared in a timely fashion, so most of the papers were not collected until a year or so ago. Because most of the papers are in the nature of advancing theory or solving specific problems, as opposed to status reports, it is believed that the contents of this volume will be of lasting interest to the Bayesian community. The workshop was organized to bring together researchers from differ ent fields to examine critically maximum-entropy and Bayesian methods in science, engineering, medicine, economics, and other disciplines. Some of the papers were chosen specifically to kindle interest in new areas that may offer new tools or insight to the reader or to stimulate work on pressing problems that appear to be ideally suited to the maximum-entropy or Bayes ian method.

The special issue contains research papers with various topics in many different branches of mathematics, applied mathematics, and mathematical physics. Each paper presents mathematical theory, methods, and their application based on current and recent developing symmetric polynomials. Also, each one aims to provide the full understanding of current research problems, theories, and applications on the chosen topics and contains the most recent advances made in the area of symmetric functions and polynomials.

Chapter wise & Topic wise presentation for ease of learning Quick Review for in depth study Mind maps for clarity of concepts All MCQs with explanation against the correct option Some important questions developed by ‘Oswaal Panel’ of experts Previous Year’s Questions Fully Solved Complete Latest NCERT Textbook & Intext Questions Fully Solved Quick Response (QR Codes) for Quick Revision on your Mobile Phones / Tablets Expert Advice how to score more suggestion and ideas shared

Maximum Entropy Solutions to Scientific Problems

Entropy and entropy generation play essential roles in our understanding of many diverse phenomena ranging from cosmology to biology. Their importance is manifest in areas of immediate practical interest such as the provision of global energy as well as in others of a more fundamental flavour such as the source of order and complexity in nature. They also form the basis of most

modern formulations of both equilibrium and nonequilibrium thermodynamics. Today much progress is being made in our understanding of entropy and entropy generation in both fundamental aspects and application to concrete problems. The purpose of this volume is to present some of these recent and important results in a manner that not only appeals to the entropy specialist but also makes them accessible to the nonspecialist looking for an overview of the field. This book contains fourteen contributions by leading scientists in their fields. The content covers such topics as quantum thermodynamics, nonlinear processes, gravitational and irreversible thermodynamics, the thermodynamics of Taylor dispersion, higher order transport, the mesoscopic theory of liquid crystals, simulated annealing, information and biological aspects, global energy, photovoltaics, heat and mass transport and nonlinear electrochemical systems. Audience: This work will be of value to physicists, chemists, biologists and engineers interested in the theory and applications of entropy and its generation.

This book constitutes the refereed proceedings of the Second International Conference on Evolutionary Multi-Criterion Optimization, EMO 2003, held in Faro, Portugal, in April 2003. The 56 revised full papers presented were carefully reviewed and selected from a total of 100 submissions. The papers are organized in topical sections on objective handling and problem decomposition, algorithm improvements, online adaptation, problem construction, performance analysis and comparison, alternative methods, implementation, and applications.

REA's Thermodynamics Problem Solver Each Problem Solver is an insightful and essential study and solution guide chock-full of clear, concise problem-solving gems. Answers to all of your questions can be found in one convenient source from one of the most trusted names in reference solution guides. More useful, more practical, and more informative, these study aids are the best review books and textbook companions available. They're perfect for undergraduate and graduate studies. This highly useful reference provides thorough coverage of pressure, work and heat, energy, entropy, first and second laws, ideal gas processes, vapor refrigeration cycles, mixtures, and solutions. For students in engineering, physics, and chemistry.

The methods of chemical thermodynamics are effectively used in many fields of science and technology. Mastering these methods and their use in practice requires profound comprehension of the theoretical questions and acquisition of certain calculating skills. This book is useful to undergraduate and graduate students in chemistry as well as chemical, thermal and refrigerating technology; it will also benefit specialists in all other fields who are interested in using these powerful methods in their practical activities.

Hidden Markov processes (HMPs) are important objects of study in many areas of pure and applied mathematics, including information theory, probability theory, dynamical systems and statistical physics, with applications in electrical engineering, computer science and molecular biology. This collection of research and survey papers presents important new results and open problems, serving as a unifying gateway for researchers in these areas. Based on talks given at the Banff International Research Station Workshop, 2007, this volume addresses a central problem of the subject: computation of the Shannon entropy rate of an HMP. This is a key quantity in statistical physics and information theory, characterising the fundamental limit on compression and closely related to channel capacity, the limit on reliable communication. Also discussed, from a symbolic dynamics and thermodynamical viewpoint, is the problem of characterizing the mappings between dynamical systems which map Markov measures to Markov (or Gibbs) measures, and which allow for Markov lifts of Markov chains.

Cambridge, England, 1988

Statistical mechanics is concerned with defining the thermodynamic properties of a macroscopic sample in terms of the properties of the microscopic systems of which it is composed. The previous book Introduction to Statistical Mechanics provided a clear, logical, and self-contained treatment of equilibrium statistical mechanics starting from Boltzmann's two statistical assumptions, and presented a wide variety of applications to diverse physical assemblies. An appendix provided an introduction to non-equilibrium statistical mechanics through the Boltzmann equation and its extensions. The coverage in that book was enhanced and extended through the inclusion of many accessible problems. The current book provides solutions to those problems. These texts assume only introductory courses in classical and quantum mechanics, as well as familiarity with multi-variable calculus and the essentials of complex analysis. Some knowledge of thermodynamics is also assumed, although the analysis starts with an appropriate review of that topic. The targeted audience is first-year graduate students and advanced undergraduates, in physics, chemistry, and the related physical sciences. The goal of these texts is to help the reader obtain a clear working knowledge of the very useful and powerful methods of equilibrium statistical mechanics and to enhance the understanding and appreciation of the more advanced texts.

This book provides a self-contained introduction to the mathematical theory of hyperbolic systems of conservation laws, with particular emphasis on the study of discontinuous solutions, characterized by the appearance of shock waves. This area has experienced substantial progress in very recent years thanks to the introduction of new techniques, in particular the front tracking algorithm and the semigroup approach. These techniques provide a solution to the long standing open problems of uniqueness and stability of entropy weak solutions. This volume is the first to present a comprehensive account of these new, fundamental advances. It also includes a detailed analysis of the stability and convergence of the front tracking algorithm. A set of problems, with varying difficulty is given at the end of each chapter to verify and expand understanding of the concepts and techniques previously discussed. For researchers, this book will provide an indispensable reference to the state of the art in the field of hyperbolic systems of conservation laws.

This book offers solutions to the problems commonly encountered by economists trying to squeeze information out of partial or incomplete data--which is usually what they have to work with.

The book describes a useful tool for solving linear inverse problems subject to convex constraints. The method of maximum entropy in the mean automatically takes care of the constraints. It consists of a technique for transforming a large dimensional inverse problem into a small dimensional non-linear variational problem. A variety of mathematical aspects of the maximum entropy method are explored as well. Contents:A Collection of Linear Inverse ProblemsThe Basics about Linear Inverse ProblemsRegularization in Hilbert Spaces: Deterministic and Stochastic ApproachesMaxentropic Approach to Linear Inverse ProblemsFinite Dimensional ProblemsSome Simple Numerical Examples and Moment ProblemsSome Infinite Dimensional ProblemsTomography, Reconstruction from Marginals and Transportation ProblemsNumerical Inversion of Laplace TransformsMaxentropic Characterization of Probability DistributionsIs an image Worth a Thousand Words? Readership: Researchers in mathematical modeling. Keywords:Inverse Problems;Constrained Inverse Problems;Maximum Entropy;Maximum Entropy in the MeanKey Features:There are no other books using the method of maximum entropy in the mean to solve constrained linear problems with error in the dataIt includes interactive software, that can be used to solve many problemsReviews: “This book serves as lecture notes and is suitable for a graduate-level course on inverse problems. It covers a broad subject, gives explanations in sufficient detail, and helps readers learn to apply the presented methods. The book includes a nice collection of inverse problems and

strategies to solve them, offers examples, and maintains a good balance between theoretical and applied aspects of the subject." Mathematical Reviews "This monograph provides a thorough survey of maximum entropy methods for linear inverse problems. It is well written. This text can be recommended to experts as well as graduate students interested in the stochastic connection in inverse problems." Zentralblatt MATH

This Is The First Comprehensive Book About Maximum Entropy Principle And Its Applications To A Diversity Of Fields Like Statistical Mechanics, Thermo-Dynamics, Business, Economics, Insurance, Finance, Contingency Tables, Characterisation Of Probability Distributions (Univariate As Well As Multivariate, Discrete As Well As Continuous), Statistical Inference, Non-Linear Spectral Analysis Of Time Series, Pattern Recognition, Marketing And Elections, Operations Research And Reliability Theory, Image Processing, Computerised Tomography, Biology And Medicine. There Are Over 600 Specially Constructed Exercises And Extensive Historical And Bibliographical Notes At The End Of Each Chapter.The Book Should Be Of Interest To All Applied Mathematicians, Physicists, Statisticians, Economists, Engineers Of All Types, Business Scientists, Life Scientists, Medical Scientists, Radiologists And Operations Researchers Who Are Interested In Applying The Powerful Methodology Based On Maximum Entropy Principle In Their Respective Fields.

Highlighting several versions of the flexible maximum entropy (ME) method, this reference provides strategies for solving various practical, inverse and undetermined problems. It explores the advantages and disadvantages of using different methods and backs up solutions with specific examples.

Proceedings of the Thirteenth International Workshop on Maximum Entropy and Bayesian Methods

Since the landmark contributions of C. E. Shannon in 1948, and those of E. T. Jaynes about a decade later, applications of the concept of entropy and the principle of maximum entropy have proliterated in science and engineering. Recent years have witnessed a broad range of new and exciting developments in hydrology and water resources using the entropy concept. These have encompassed innovative methods for hydrologic network design, transfer of information, flow forecasting, reliability assessment for water distribution systems, parameter estimation, derivation of probability distributions, drainage-network analysis, sediment yield modeling and pollutant loading, bridge-scour analysis, construction of velocity profiles, comparative evaluation of hydrologic models, and so on. Some of these methods hold great promise for advancement of engineering practice, permitting rational alternatives to conventional approaches. On the other hand, the concepts of energy and energy dissipation are being increasingly applied to a wide spectrum of problems in environmental and water resources. Both entropy and energy dissipation have their origin in thermodynamics, and are related concepts. Yet, many of the developments using entropy seem to be based entirely on

statistical interpretation and have seemingly little physical content. For example, most of the entropy-related developments and applications in water resources have been based on the information-theoretic interpretation of entropy. We believe if the power of the entropy concept is to be fully realized, then its physical basis has to be established.