Article

Viscoelastic MHD Nanofluid Thin Film Flow over an Unsteady Vertical Stretching Sheet with Entropy Generation

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Abstract: The boundary-layer equations for mass and heat energy transfer with entropy generation are analyzed for the two-dimensional viscoelastic second-grade nanofluid thin film flow in the presence of a uniform magnetic field (MHD) over a vertical stretching sheet. Different factors, such as the thermophoresis effect, Brownian motion, and concentration gradients, are considered in the nanofluid model. The basic time-dependent equations of the nanofluid flow are modeled and transformed to the ordinary differential equations system by using similarity variables. Then the reduced system of equations is treated with the Homotopy Analysis Method to achieve the desire goal. The convergence of the method is prescribed by a numerical survey. The results obtained are more efficient than the available results for the boundary-layer equations, which is the beauty of the Homotopy Analysis Method, and shows the consistency, reliability, and accuracy of our obtained results. The effects of various parameters, such as Nusselt number, skin friction, and Sherwood number, on nanoliquid film flow are examined. Tables are displayed for skin friction, Sherwood number, and Nusselt number, which analyze the sheet surface in interaction with the nanofluid flow and other informative characteristics regarding this flow of the nanofluids. The behavior of the local Nusselt number and the entropy generation is examined numerically with the variations in the non-dimensional numbers. These results are shown with the help of graphs and briefly explained in the discussion. An analytical exploration is described for the unsteadiness parameter on the thin film. The larger values of the unsteadiness parameter increase the velocity profile. The nanofluid film velocity shows decline due the increasing values of the magnetic parameter. Moreover, a survey on the physical embedded parameters is given by graphs and discussed in detail.

Keywords: entropy generation; second-grade fluid; nanofluid; liquid films; thin film; time depending stretching surface; magnetic field; HAM

Entropy Generation On Mhd Viscoelastic Nanofluid Over A

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Entropy Generation On Mhd Viscoelastic Nanofluid Over A:

Applications of Heat, Mass and Fluid Boundary Layers R. O. Fagbenle,O. M. Amoo,S. Aliu,A. Falana,2020-01-22 Applications of Heat Mass and Fluid Boundary Layers brings together the latest research on boundary layers where there has been remarkable advancements in recent years This book highlights relevant concepts and solutions to energy issues and environmental sustainability by combining fundamental theory on boundary layers with real world industrial applications from among others the thermal nuclear and chemical industries The book s editors and their team of expert contributors discuss many core themes including advanced heat transfer fluids and boundary layer analysis physics of fluid motion and viscous flow thermodynamics and transport phenomena alongside key methods of analysis such as the Merk Chao Fagbenle method This book s multidisciplinary coverage will give engineers scientists researchers and graduate students in the areas of heat mass fluid flow and transfer a thorough understanding of the technicalities methods and applications of boundary layers with a unified approach to energy climate change and a sustainable future Presents up to date research on boundary layers with very practical applications across a diverse mix of industries Includes mathematical analysis to provide detailed explanation and clarity Provides solutions to global energy issues and environmental sustainability **Mathematics and Computer Science, Volume 2** Sharmistha Ghosh,M. Niranjanamurthy,Krishanu Deyasi,Biswadip Basu Mallik,Santanu Das,2023-08-15 MATHEMATICS AND COMPUTER SCIENCE This second volume in a new multi volume set builds on the basic concepts and fundamentals laid out in the previous volume presenting the reader with more advanced and cutting edge topics being developed in this exciting field This second volume in a new series from Wiley Scrivener is the first of its kind to present scientific and technological innovations by leading academicians eminent researchers and experts around the world in the areas of mathematical sciences and computing Building on what was presented in volume one the chapters focus on more advanced topics in computer science mathematics and where the two intersect to create value for end users through practical applications The chapters herein cover scientific advancements across a diversified spectrum that includes differential as well as integral equations with applications computational fluid dynamics nanofluids network theory and optimization control theory machine learning and artificial intelligence big data analytics Internet of Things cryptography fuzzy automata statistics and many more Readers of this book will get access to diverse ideas and innovations in the field of computing together with its growing interactions in various fields of mathematics Whether for the engineer scientist student academic or other industry professional this is a must have for any library **Thin Film Processes** Hyun Wook Jung,2020-12-29 Thin film processes are significantly incorporated in manufacturing display panels secondary batteries fuel solar cells catalytic films membranes adhesives and other commodity films This Special Issue on Thin Film Processes of Processes listed recent progress on thin film processes covering theoretical considerations experimental observations and computational techniques Articles in this Issue consider comprehensive studies on thin film processes and related materials

Advanced Applications of Computational Mathematics Akshay Kumar,Mangey Ram,Hari Mohan Srivastava,2022-09-01 This book Advanced Applications of Computational Mathematics covers multidisciplinary studies containing advanced research in the field of computational and applied mathematics The book includes research methodology techniques applications and algorithms The book will be very useful to advanced students researchers and practitioners who are involved in the areas of computational and applied mathematics and engineering **Proceedings of the 1st International Conference on Recent Advancements in Materials Science and Technology, Volume I** P. Sakthivel,Mangalaraja Ramalinga Viswanathan,K. Ravichandran,2024-12-26 This book presents peer reviewed and selected papers from the 1st International Conference on Recent Advancements in Materials Science and Technology held at Karpagam Academy of Higher Education in Coimbatore India on 29 30 January 2024 Experts across the world share the latest developments in their respective fields within materials science including nanomaterials biomaterials optical materials construction materials composite materials and more Additionally addressing sustainability and the importance of international collaboration this book serves as an up to date and effective resource for researchers academics industrialists and students looking to understand the state of numerous materials science subfields **Symmetry and Fluid Mechanics** Rahmat Ellahi,2020-03-25 Since the 1980s attention has increased in the research of fluid mechanics due to its wide application in industry and phycology Major advances have occurred in the modeling of key topics such Newtonian and non Newtonian fluids nanoparticles thermal management and physiological fluid phenomena in biological systems which have been published in this Special Issue on symmetry and fluid mechanics for Symmetry Although this book is not a formal textbook it will be useful for university teachers research students and industrial researchers and for overcoming the difficulties that occur when considering the nonlinear governing equations For such types of equations obtaining an analytic or even a numerical solution is often more difficult This book addresses this challenging job by outlining the latest techniques In addition the findings of the simulation are logically realistic and meet the standard of sufficient scientific value

Mathematical Modelling of Fluid Dynamics and Nanofluids Katta Ramesh,Fateh Mebarek-Oudina,Basma Souayeh,2023-09-29 Mathematical Modelling of Fluid Dynamics and Nanofluids serves as a comprehensive resource for various aspects of fluid dynamics simulations nanofluid preparation and numerical techniques The book examines the practical implications and real world applications of various concepts including nanofluids magnetohydrodynamics heat and mass transfer and radiation By encompassing these diverse domains it offers readers a broad perspective on the interconnectedness of these fields The primary audience for this book includes researchers and graduate students who possess a keen interest in interdisciplinary studies within the realms of fluid dynamics nanofluids and biofluids Its content caters to those who wish to deepen their knowledge and tackle complex problems at the intersection of these disciplines

Applied Mathematics and Scientific Computing B. Rushi Kumar,R. Sivaraj,B. S. R. V. Prasad,M. Nalliah,A. Subramanyam

Reddy,2019-02-01 This volume is the first of two containing selected papers from the International Conference on Advances in Mathematical Sciences ICAMS held at the Vellore Institute of Technology in December 2017 This meeting brought together researchers from around the world to share their work with the aim of promoting collaboration as a means of solving various problems in modern science and engineering The authors of each chapter present a research problem techniques suitable for solving it and a discussion of the results obtained These volumes will be of interest to both theoretical and application oriented individuals in academia and industry Papers in Volume I are dedicated to active and open areas of research in algebra analysis operations research and statistics and those of Volume II consider differential equations fluid mechanics and graph theory *Micro and Nanofluid Convection with Magnetic Field Effects for Heat and Mass Transfer Applications using MATLAB®* Chakravarthula S K Raju,Ilyas Khan,Suresh Kumar Raju S,Mamatha S Upadhya,2022-06-02 Micro and Nanofluid Convection with Magnetic Field Effects for Heat and Mass Transfer Applications using MATLAB examines the performance of micro and nanofluids with various physical effects such as magnetic field slip effects radiation and heat sources Heat and mass transfer enhancement techniques are widely used in many applications in the heating and cooling or freezing process to make possible a reduction in weight and size or enhance performance during heat and mass exchanges The book covers the two categories of flow techniques active and passive It discusses various considerations in the engineering sciences in the melting process polymer industry and in metallurgy To be more precise it may be pointed out that many metal surgical developments involve the cooling of continuous strips or filaments by drawing them through a quiescent fluid and in that process of drawing these strips are sometimes stretched In all these cases the properties of the final product depend to a great extent on the rate of cooling by drawing such strips in an electrically conducting fluid subject to a magnetic field and thermal radiation Provides information about the governing equations for all three types of flow geometries Explains micro polar fluid flow modeling Offers detailed coverage of boundary value problems using MATLAB **Modern world heat transfer problems: Role of nanofluids and fractional order approaches** Adnan,Umar Khan,Ilyas Khan,2023-01-31 **Nanofluids and Nano Composites for Energy Systems** Dharmendra Tripathi,Ravi Kumar Sharma,Pradeep G. Siddheshwar,Khaleed S. Mekheimer,2025-05-23 This book presents a very useful and easily comprehensible valuable collection of experimental and mathematical studies on nanofluids nanocomposites and addresses current and future applications This book serves as a ready reference for researchers working in the areas of dynamics of nanofluids This book points toward technical expansions linked with energy nanotechnology applications energy storage solar photovoltaic and other related areas This book provides insights related to various forms of applications in renewable energy systems and other industrial applications Emerging Technologies in Data Mining and Information Security Paramartha Dutta,Satyajit Chakrabarti,Abhishek Bhattacharya,Soumi Dutta,Vincenzo Piuri,2022-09-28 This book features research papers presented at the International Conference on Emerging Technologies in Data Mining and Information

Security IEMIS 2022 held at Institute of Engineering Management Kolkata India during February 23 25 2022 The book is organized in three volumes and includes high quality research work by academicians and industrial experts in the field of computing and communication including full length papers research in progress papers and case studies related to all the areas of data mining machine learning Internet of Things IoT and information security *Nanomaterials and Nanoliquids: Applications in Energy and Environment* Dharmendra Tripathi,Ravi Kumar Sharma,Hakan F. Oztop,Rajamohan Natarajan,2023-11-15 This book discusses recent work on the use of nanoparticles in energy and environment related work This book presents experimental numerical analytical and theoretical work on the use of nanomaterials in energy and environment This book helps to highlight cutting edge research and is a ready reference for the researchers working in this arena of academia and industries This book provides insights related to various forms of nanotechnological applications in green buildings environmental and electrochemical solar distillation systems green energy storage tank of the SWH system solar concentrator system s receiver and CFD simulations of various aspects of nanofluids hybrid nanofluids which are particularly useful valuable for the betterment of society **Recent Trends in Coatings and Thin Film–Modeling and Application** Rahmat Ellahi,2021-08-31 This Special Issue contains articles include but not limited to empirical analytical or design oriented approaches to the following topics Monitoring of carrying capacity and mechanisms for managing tourist flows in rural areas Systems and tools to measure the social economic and environmental sustainability of rural tourism Integration between public tourism policies and private strategies in the promotion and implementation of sustainable practices Policies for promoting public participation in the planning and development of sustainable rural tourism The impacts of tourism on traditional agricultural activities Identity enhancement of the territory and its productions Good practices in the implementation of rural tourism sustainability *Symmetry and Exact Solutions of Nonlinear Mathematical Physics Equations* Gangwei Wang,Xiangpeng Xin ,Samir A. El-Tantawy,2024-08-13 Nonlinear problems originating from applied science that is closely related to practices contain rich and extensive content It makes the corresponding nonlinear models also complex and diverse Due to the intricacy and contingency of nonlinear problems unified mathematical methods still remain far and few between In this regard the comprehensive use of symmetric methods along with other mathematical methods becomes an effective option to solve nonlinear problems Fluid Interfaces Eduardo Guzmán,2021-03-02 Fluid interfaces are promising candidates for confining different types of materials e g polymers surfactants colloids and even small molecules to be used in designing new functional materials with reduced dimensionality The development of such materials requires a deepening of the physicochemical bases underlying the formation of layers at fluid interfaces as well as on the characterization of their structures and properties This is of particular importance because the constraints associated with the assembly of materials at the interface lead to the emergence of equilibrium and features of dynamics in the interfacial systems which are far removed from those conventionally found in traditional materials This Special Issue is

devoted to studies on the fundamental and applied aspects of fluid interfaces and attempts to provide a comprehensive perspective on the current status of the research field   *Thermodynamics of Newtonian and non-Newtonian nanofluids with recent advancements* Mustafa Inc,Noor Saeed Khan,Hammad Khalil,Ishak Hashim,2024-01-15   *Nanofluid Dynamics and Transport Phenomenon* Reshu Gupta,Mukesh Kumar Awasthi,Dhananjay Yadav,Yashvir Singh,2024-12-04 The text offers a detailed presentation of mathematical numerical and experimental techniques for nanofluids It further covers the synthesis characterization stability and heat transport The book comprehensively discusses topics such as the comparison of heat transfer models flow features of ternary hybrid nanofluids thermodynamics and mass diffusion and natural convection in triangular cavities This book Emphasizes the enhancement of heat transfer processes through nanoparticles extending beyond heat transfer to applications in renewable energy Explores the applications of nanofluids in enhancing food processing and agricultural practices Covers thermal instability of couple stress on viscous elastic nanofluid flow and natural convection in a triangular cavity Explains concepts including nanofluid based energy storage mass diffusion thermodynamics and nanofluid synthetic techniques Presents topics such as numerical methods fluid dynamics simulation magnetohydrodynamics heat and mass transfer and radiation It is primarily written for senior undergraduates graduate students and academic researchers in the fields of mechanical engineering aerospace engineering automotive engineering industrial and production engineering energy engineering fluid dynamics and tribology   *CFD Simulation* Fateh Mebarek-Oudina,2025-05-19 Information about the author Fateh Mebarek Oudina received his PhD in 2010 He has published more than 120 papers in reputed international journals Currently he works as a full professor at Skikda University in Algeria and regularly serves as a reviewer for more than 250 international journals He is ranked in the Top 2% Scientists Worldwide 2020 2021 2022 2023 by Stanford University His research work is focused on heat and mass transfer MHD mathematical simulation and modelling biofluids nanofluids hybrid nanofluids ternary nanofluids microfluidics and computational fluid dynamics Information abiout the book Mathematical modeling presented in the book is designed to help engineers understand physical systems including magnetohydrodynamic effects on the non Newtonian fluid flow and multiphase flow Special attention will be given to heat transfer and entropy generation analysis on hybrid nanofluids The process of entropy generation for nanofluid flows through porous channels will also be discussed and analyzed by means of a theoretical approach and CFD modeling Some applications to blood mediated gold silver nanoparticles will be presented with detailed numerical examples The book is designed to facilitate a more profound understanding for engineers of adopting CFD models to natural manufacturing environments Overall the primary objective of the book is to present mathematical modeling with CFD applications to simulate real world engineering industrial and medical science problems to expose various analytical and numerical techniques and at the same time extend to expose researchers and academicians to the recent advancement in these diverse fields   *Applications of Hybrid Nanofluids in Science and Engineering* A. K. Pandey,H. Upreti,O. D.

Makinde,A. J. Chamkha,2025-03-18 Applications of Hybrid Nanofluids in Science and Engineering delves deep into the multifaceted realms in which these dynamic fluids are playing a pivotal role in various fields This comprehensive volume elucidates the diverse applications and promising potentials of hybrid nanofluids It introduces hybrid nanofluids and their preparation methods thermophysical properties advantages applications and future scope Models to compute the effective thermophysical properties of hybrid nanofluids are also discussed along with their limitations In the application section mathematical models are formulated to contemplate the flow of hybrid nanofluids through different surfaces geometries under different situations Also the entropy generation minimization in hybrid nanofluid flow is discussed with its application in refrigeration power generation and other processes The subject matter in this book will enable the reader to do the following Learn the ins and outs of hybrid nanofluids from how they are made to the special characteristics they embody Explore hybrid nanofluids potential in thermal management energy systems materials science biomedical engineering and more Use advanced computational and analytical methods to analyse complex fluid dynamics models Anticipate the impact of hybrid nanofluid research on upcoming sectors like renewable energy and innovative manufacturing This book is aimed at researchers and graduate students in mechanical and chemical engineering and materials science

The Enigmatic Realm of **Entropy Generation On Mhd Viscoelastic Nanofluid Over A**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing short of extraordinary. Within the captivating pages of **Entropy Generation On Mhd Viscoelastic Nanofluid Over A** a literary masterpiece penned with a renowned author, readers embark on a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book is core themes, assess its distinct writing style, and delve into its lasting impact on the hearts and minds of those who partake in its reading experience.

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