

Eigenvalue Solutions for Euler-Bernoulli Beams on Two-Parameter Foundations Using Stodola-Vianello Iteration Method and Polynomial Basis Functions

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ABSTRACT : The critical buckling load determination of axially compressed simply supported Euler-Bernoulli beams rested on two-parameter foundations (EBBo2PF) of Filomenko-Borodich, Pasternak or Vlasov is important for their analysis and design. This work uses the Stodola-Vianello iteration method to formulate the governing domain equation, and constructs a fourth degree polynomial shape function that satisfies the simply supported ends. By substitution of the derived polynomial basis function in the Stodola-Vianello iterations and use of boundary conditions, the four constants of integration in the algebraic formulation are calculated. The requirement for convergence of the iteration at the first iteration is used to establish the buckling equation, whose roots yield the eigenvalue from which the critical buckling load is derived. The critical buckling load expression is found to depend upon the two beam-foundation parameters $\beta_1 l^4$ and $\beta_2 l^2$; and presented in tabulated forms for given values of the foundation parameters. The critical buckling load solution obtained in this study showed insignificant difference of less than 0.075% from the previously reported solution by Arghel and Mares for all values of the foundation parameters. It is further found that when the second foundation parameter β_2 vanishes the buckling load becomes identical to the critical buckling load for Euler-Bernoulli beams on Winkler foundations, EBBoWF.

KEYWORDS Euler-Bernoulli beam on two-parameter foundation, eigenvalue, critical buckling load, characteristic buckling equation Stodola-Vianello iteration method.

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1. INTRODUCTION

Several problems in structural and foundation engineering can be analyzed as beam on elastic foundation problems. Such problems are formulated using the theories of beams and elastic foundations. They are complex soil structure interaction problems and certain other engineering problems have analogous equations and can be solved via the beam on elastic foundation approach (Dutta et al, 2021). In such problems, the structural footing beam and the soil are required to act together in supporting the loads (Dutta et al, 2021). The theories of beams have been derived by Euler and independently by Bernoulli, Timoshenko, Levinson (1981), Sayyad and Ghugal (2011), Dabake and Ghugal (2013) and several other researchers.

Similarly, elastic foundation theories have been developed by Winkler, Pasternak, Vlasov, Filomenko and Borodich and Hetenyi (1946). Euler and Bernoulli working independently used orthogonality hypothesis of cross-sectional planes normal to the longitudinal axis of the beam before deformation would retain plane and normal to the longitudinal axis after deformation to develop the classical beam theory now credited to them and called the Euler-Bernoulli beam theory (EBBT) (Emadi et al 2023). The normality assumption implies that transverse shear deformation is neglected, thus limiting the scope of application of the EBBT to thin plates for

The Foundations Of Science The Missing Parameter

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The Foundations of Science Arthur M. Young,1984-01 *Energy Psychology* Fred P. Gallo,2004-12-28 *Energy Psychology Explorations at the Interface of Energy Cognition Behavior and Health* Second Edition introduces the exciting new paradigm of energy psychology and presents the latest research on the subject This second edition begins by tracing the roots of energy psychology and contrasting them with contemporary approaches and the **Unified Field Mechanics II: Formulations And Empirical Tests - Proceedings Of The Xth Symposium Honoring Noted French Mathematical Physicist Jean-pierre Vigier** Richard L Amoroso,Louis H Kauffman,Peter Rowlands,Gianni Albertini,2018-01-08 This volume recording the 10th international symposium honoring noted French mathematical physicist Jean Pierre Vigier surveys and continues to develop Unified Field Mechanics UFM from the perspective of Multiverse cosmology and Topological Field Theory UFM represents a developing paradigm shift with many new parameters extending the Standard Model to a 3rd regime of Natural Science beyond Quantum Mechanics UFM is now experimentally testable thus putatively able to demonstrate the existence of large scale additional dimensionality LSXD test for QED violating phenomena and surmount the quantum uncertainty principle leading to a new Age of Discovery paling all prior ages in the historical progression Classical Mechanics 3D to Quantum Mechanics 4D and now to the birth of the 3rd regime of UFM in additional dimensionality correlating with M Theory Many still consider the Planck scale as the basement of reality This could only be considered true under the limitations of the Standard Model As we methodically enter the new regime a profound understanding of the multiverse and additional dimensionality beckons **Energy Diagnostic and Treatment Methods** Fred P Gallo,2000-02-08 A very old overcoat is recycled numerous times into a variety of garments **Towards a History of Consciousness** Vwadek P. Marciniak,2006 *Towards a History of Consciousness Space Time and Death* offers a cogent and compelling discussion of the neglected topic of the history of consciousness An analysis of our postmodern ontology reveals deep but neglected roots What are those roots and how did they grow Is there a self without consciousness What is the relation of the self to the individual Does the recognition of death contribute to the growth of consciousness As a survey of western history this work pushes the boundaries of the understanding of consciousness in intriguing and sometimes provocative directions This integrative study is intended for the serious curious student and thinker **Books in Print**,1977 Wittgenstein's Remarks on the Foundations of AI Stuart G. Shanker,2002-01-31 Wittgenstein s Remarks on the Foundations of AI is a valuable contribution to the study of Wittgenstein s theories and his controversial attack on artificial intelligence which successfully crosses a number of disciplines including philosophy psychology logic artificial intelligence and cognitive science to provide a stimulating and searching analysis **The Fog Island Argument** Thorbjørn Mann,2007-06-25 The book explores two issues about design The first evaluation of arguments used in discussions about design planning policy proposals a subject neglected by traditional logic presents proposals for their systematic assessment

The second is based on the insight that design arguments contain premises spanning the entire range of types of human knowledge whose validation draws on all approaches to human inquiry including but not limited to scientific method. A general education course using exposure to design tasks therefore would provide students with a better framework for exploring and understanding all these inquiry forms and how they relate to one another.

Scientific and Technical Books and Serials in Print, 1989. *Advances in the Statistical Sciences: Foundations of Statistical Inference* I.B.

MacNeill, G. Umphrey, 2012-12-06. On May 27-31, 1985, a series of symposia was held at The University of Western Ontario, London, Canada, to celebrate the 70th birthday of Professor V. M. Joshi. These symposia were chosen to reflect Professor Joshi's research interests as well as areas of expertise in statistical science among faculty in the Departments of Statistical and Actuarial Sciences, Economics, Epidemiology and Biostatistics, and Philosophy. From these symposia, the six volumes which comprise the Joshi Festschrift have arisen. The 117 articles in this work reflect the broad interests and high quality of research of those who attended our conference. We would like to thank all of the contributors for their superb cooperation in helping us to complete this project. Our deepest gratitude must go to the three people who have spent so much of their time in the past year typing these volumes: Jackie Bell, Lise Constant, and Sandy Tarnowski. This work has been printed from camera-ready copy produced by our Vax 785 computer and QMS Lasergraphix printers using the text processing software TEX. At the initiation of this project, we were neophytes in the use of this system. Thank you, Jackie, Lise, and Sandy, for having the persistence and dedication needed to complete this undertaking.

The Missing Link Roy Abraham Varghese, 2013. *The Missing Link* blazes a unique trail through the conundrums and controversies generated by evolutionary theory and religious thought. To date, these debates have centered on the origin of species. This book, however, turns the spotlight on the origins of consciousness, thought, and the self while also considering the relationship between God and science. Remarkably, Darwin himself highlighted the relevance of the origin of consciousness to the question of a creator. Therefore, *The Missing Link* works within a framework that was laid out at the dawn of the creation-evolution debate. Since that time, however, this framework has rarely been considered or explored. The unifying theme of this volume is the conclusion that the existence of God is grounded in rational thought. Contributors to *The Missing Link* include three Nobel Prize winners, renowned scientists from Oxford, Cambridge, and Harvard, and noted contemporary philosophers of consciousness, language, and the self.

Language, Logic, and Concepts Ray Jackendoff, Paul Bloom, Karen Wynn, 2002. A wide-ranging collection of essays inspired by the memory of the cognitive psychologist John Macnamara.

Handbook of Research Methods in Abnormal and Clinical Psychology Dean McKay, 2008. *The Handbook of Research Methods in Abnormal and Clinical Psychology* presents a diverse range of areas critical to any researcher or student entering the field. It provides valuable information on the foundations of research methods, including validity in experimental design, ethics, and statistical methods. The contributors discuss design and instrumentation for methods that are particular to abnormal and clinical psychology, including behavioral assessment.

psychophysiological assessment and observational methods They also offer details on new advances in research methodology and analysis such as meta analysis taxometric methods item response theory and approaches to determining clinical significance In addition this volume covers specialty topics within abnormal and clinical psychology from forensic psychology to behavior genetics to treatment outcome methods

Partial Identification in Econometrics and Related Topics Nguyen Ngoc Thach, Nguyen Duc Trung, Doan Thanh Ha, Vladik Kreinovich, 2024-07-31 This book covers data processing techniques with economic and financial application being the unifying theme To make proper investments in economy the authors need to have a good understanding of the future trends how will demand change how will prices change etc In general in science the usual way to make predictions is to identify a model that best fits the current dynamics and to use this model to predict the future behavior In many practical situations especially in economics our past experiences are limited As a result the authors can only achieve a partial identification It is therefore important to be able to make predictions based on such partially identified models which is the main focus of this book This book emphasizes partial identification techniques but it also describes and uses other econometric techniques ranging from more traditional statistical techniques to more innovative ones such as game theoretic approach interval techniques and machine learning Applications range from general analysis of GDP growth stock market and consumer prices to analysis of specific sectors of economics credit and banking energy health labor tourism international trade to specific issues affecting economy such as ecology national culture government regulations and the existence of shadow economy This book shows what has been achieved but even more important are remaining open problems The authors hope that this book will inspire practitioners to learn how to apply state of the art techniques especially techniques of optimal transport statistics to economic and financial problems and inspire researchers to further improve the existing techniques and to come up with new techniques for studying economic and financial phenomena The authors want to thank all the authors for their contributions and all anonymous referees for their thorough analysis and helpful comments The publication of this book and organization of the conference at which these papers were presented was supported by the Ho Chi Minh University of Banking HUB Vietnam and by the Vingroup Innovation Foundation VINIF The authors thank the leadership and staff of HUB and VINIF for providing crucial support

The Oxford Handbook of Quantitative Methods, Volume 1: Foundations Todd D. Little, 2013-01-15 Research today demands the application of sophisticated and powerful research tools Fulfilling this need The Oxford Handbook of Quantitative Methods is the complete tool box to deliver the most valid and generalizable answers to today's complex research questions It is a one stop source for learning and reviewing current best practices in quantitative methods as practiced in the social behavioral and educational sciences Comprising two volumes this handbook covers a wealth of topics related to quantitative research methods It begins with essential philosophical and ethical issues related to science and quantitative research It then addresses core measurement topics before delving into the design of studies Principal issues related to modern estimation

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Epistemology: Key Concepts in Philosophy Christopher Norris,2005-10-20 Christopher Norris attempts to make epistemology the theory of knowledge accessible to students and those with little prior knowledge of the subject through a series of debates which aim to give an balanced overview **Applied Statistics II** Rebecca M. Warner,2020-01-14 Rebecca M Warner s bestselling *Applied Statistics From Bivariate Through Multivariate Techniques* has been split into two volumes for ease of use over a two course sequence *Applied Statistics II Multivariable and Multivariate Techniques Third Edition* is a core multivariate statistics text based on chapters from the second half of the original book The text begins with two new chapters an introduction to the new statistics and a chapter on handling outliers and missing values All chapters on statistical control and multivariable or multivariate analyses from the previous edition are retained with the moderation chapter heavily revised and new chapters have been added on structural equation modeling repeated measures and on additional statistical techniques Each chapter includes a complete example and begins by considering the types of research questions that chapter s technique can answer progresses to data screening and provides screen shots of SPSS menu selections and output and concludes with sample results sections By hand computation is used where possible to show how elements of the output are related to each other and to obtain confidence interval and effect size information when SPSS does not provide this Datasets are available on the accompanying website Bundle and Save *Applied Statistics II Applied Statistics I Basic Bivariate Techniques Third Edition Bundle Volume I and II* ISBN 978 1 0718 1337 9 An R Companion for *Applied Statistics II Multivariable and Multivariate Techniques Applied Statistics II Bundle* ISBN 978 1 0718 3618 7

Computational Modeling of Genetic and Biochemical Networks James M. Bower,Hamid Bolouri,2001 How new modeling techniques can be used to explore functionally relevant molecular and cellular relationships *Inquiries in Linguistic Development* Roumyana Slabakova,Silvina A. Montrul,Philippe Prévost,2006-04-05 The focus of this collection is on important themes in L2 acquisition the nature of grammatical systems developed by language learners in L1 acquisition third language acquisition and bilingualism and language attrition The chapters present an interesting mix of theoretical contributions overview studies and experimental designs exploring various research questions such as learnability and access to UG L1 influence the nature of initial and endstate grammars and variability The linguistic domains investigated are also extremely diverse morphosyntax phonology the lexicon argument realization language processing and interface phenomena This book edited and written by McGill University alumni is intended as a tribute to Lydia White s contribution to the field of generative

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