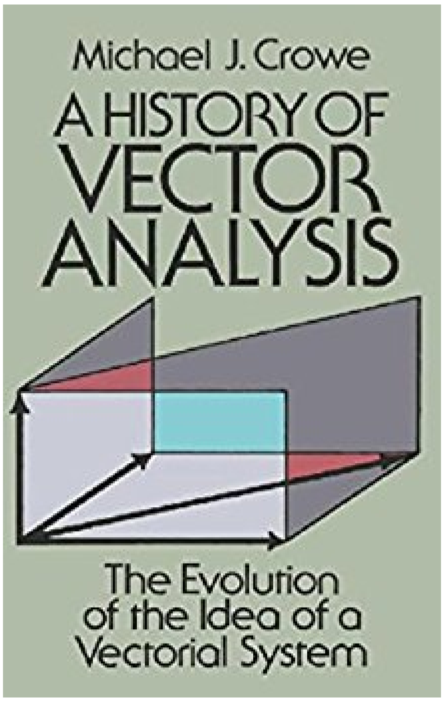
A History Of Vector Analysis: The Evolution Of The Idea Of A Vectorial System



Synopsis

On October 16, 1843, Sir William Rowan Hamilton discovered quaternions and, on the very same day, presented his breakthrough to the Royal Irish Academy. Meanwhile, in a less dramatic style, a German high school teacher, Hermann Grassmann, was developing another vectorial system involving hypercomplex numbers comparable to quaternions. The creations of these two mathematicians led to other vectorial systems, most notably the system of vector analysis formulated by Josiah Willard Gibbs and Oliver Heaviside and now almost universally employed in mathematics, physics and engineering. Yet the Gibbs-Heaviside system won acceptance only after decades of debate and controversy in the latter half of the nineteenth century concerning which of the competing systems offered the greatest advantages for mathematical pedagogy and practice.This volume, the first large-scale study of the development of vectorial systems, traces he rise of the vector concept from the discovery of complex numbers through the systems of hypercomplex numbers created by Hamilton and Grassmann to the final acceptance around 1910 of the modern system of vector analysis. Professor Michael J. Crowe (University of Notre Dame) discusses each major vectorial system as well as the motivations that led to their creation, development, and acceptance or rejection.The vectorial approach revolutionized mathematical methods and teaching in algebra, geometry, and physical science. As Professor Crowe explains, in these areas traditional Cartesian methods were replaced by vectorial approaches. He also presents the history of ideas of vector addition, subtraction, multiplication, division (in those systems where it occurs) and differentiation. His book also contains refreshing portraits of the personalities involved in the competition among the various systems.Teachers, students, and practitioners of mathematics, physics, and engineering as well as anyone interested in the history of scientific ideas will find this volume to be well written, solidly argued, and excellently documented. Reviewers have described it a s "a fascinating volume," "an engaging and penetrating historical study" and "an outstanding book (that) will doubtless long remain the standard work on the subject." In 1992 it won an award for excellence from the Jean Scott Foundation of France.

Book Information

File Size: 25569 KB

Print Length: 270 pages

Publisher: Dover Reprints (April 3, 2015)

Publication Date: April 3, 2015

Sold by:Â Digital Services LLC

Language: English

ASIN: B00VO68LBE

Text-to-Speech: Enabled

X-Ray: Not Enabled

Word Wise: Not Enabled

Lending: Not Enabled

Enhanced Typesetting: Not Enabled

Best Sellers Rank: #651,269 Paid in Kindle Store (See Top 100 Paid in Kindle Store)   #18 inÂ Kindle Store > Kindle eBooks > Nonfiction > Science > Mathematics > Applied > Vector Analysis   #83 inÂ Books > Science & Math > Mathematics > Applied > Vector Analysis

Customer Reviews

How were the concepts of vector analysis developed? How did modern vector notation become widely accepted? Who were the key players and why did quaternions fail to gain acceptance? This book is extensively documented, scholarly in its approach, sometimes a bit slow, but overall it is a fascinating look at these specific questions as well as the fundamental issue of what factors promote or delay acceptance of revolutionary ideas in science and mathematics.I did not become immediately engaged with Crowe’s style and even set the book aside after reading the prefaces and first chapter. A few months later I returned to chapter two (in part due to a previous reviewer’s high rating). And what a surprise - I suddenly found myself intrigued with Crowe’s discussion of Sir William Hamilton’s single minded focus on quaternions, the perseverance and genius of Hermann Grassmann, the critical roles played by Peter Tait and James Maxwell, and the pragmatic way in which Josiah Gibbs and Oliver Heaviside independently extracted key vectorial concepts from Hamiliton-Tait’s quaternion analysis.Crowe’s book was originally published in 1967 by University of Notre Dame, Dover reprinted it in 1985, Crowe recieved the Jean Scott Prize by the Maison des Sciences de l’Homme (Paris)in 1992, and Dover reprinted it again in 1992. Dover should be commended for making such reprints readily available at affordable prices.The discussion of Hamilton’s quaternions does not require familiarity with quaternions, but some prior acquaintance might be helpful. I encountered quaternions in another Dover reprint: Matrices and Transformations by Pettofrezzo.

Lessons we learn early become so much a part of our thinking that we cannot imagine the world otherwise. So it is with arithmetic and yes, vector analysis too. Yet logic forces us to admit that there once was a time without arithmetic or vector analysis. Crowe's carefully written and well researched book makes clear that that time for vector analysis was not so long ago. Prior to vector analysis, the description of commonplace processes such as the movement of an object was done by Cartesian analysis. So, if one wanted to describe the motion of a particle, separate equations were written for the particle's motion in each of the three spatial dimensions. Thus Newton's deceptively simple force law, F=ma becomes three equations, one for the x-axis, a second for the y-axis and a third for the z-axis. With vector analysis, these three equations collapse into one, (vector F) = (mass)x(vector a), and, it is this simplicity of expression, which is much more evident when bold fonts are available to the reviewer, that makes vectors so appealing.Crowe opens by taking us back to a time before vector analysis and provides a view of its origins in the parallelogram of forces, the geometrical interpretation of complex numbers, and the early ruminations of Leibniz on space analysis. After an enlightening discussion of complex number geometry, he eases us into the invention of quaternions by Sir W. R. Hamilton and Hamilton's intellectual struggles preceding the invention of these hypercomplex numbers. For us who are not mathematicians by trade, this struggle is instructive, for, not only do we learn something about the creative process and the history of mathematical thought, we also, if we care to retain it, learn some math.