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**Título:** Nonlinear Dynamical Systems Of Mathematical Physics

**Autor:** Blackmore, Denis; Prykarpatsky, Anatoly K. ;  
Samoylenko, Vale

**Precio:** \$1986.50

**Editorial:**

**Año:** 2011

**Tema:**

**Edición:** 1<sup>a</sup>

**Sinopsis**

**ISBN:** 9789814327152

This distinctive volume presents a clear, rigorous grounding in modern nonlinear integrable dynamics theory and applications in mathematical physics, and an introduction to timely leading-edge developments in the field \_ including some innovations by the authors themselves \_ that have not appeared in any other book.

The exposition begins with an introduction to modern integrable dynamical systems theory, treating such topics as Liouville-Arnold and Mischenko-Fomenko integrability. This sets the stage for such topics as new formulations of the gradient-holonomic algorithm for Lax integrability, novel treatments of classical integration by quadratures, Lie-algebraic characterizations of integrability, and recent results on tensor Poisson structures. Of particular note is the development via spectral reduction of a generalized de Rham-Hodge theory, related to Delsarte-Lions operators, leading to new Chern type classes useful for integrability analysis. Also included are elements of quantum mathematics along with applications to Whitham systems, gauge theories, hadronic string models, and a supplement on fundamental differential-geometric concepts making this volume essentially self-contained.

This book is ideal as a reference and guide to new directions in research for advanced students and researchers interested in the modern theory and applications of integrable (especially infinite-dimensional) dynamical systems.