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Advanced classical field theory. (English) [Zbl 1179.81002](#)

Hackensack, NJ: World Scientific (ISBN 978-981-283-895-7/hbk). x, 382 p. (2009).

The authors start from the observation that the study of classical field theory is necessary because quantum field theory is derived from the quantization of classical fields. With this in mind, they set out to explore the mathematical foundations of Lagrangian field theory and its BRST extension ‘for the purpose of quantization’.

The treatment is deep but with a narrow focus on elaborating the geometric structures underpinning the Lagrangian theory. The flavour is well captured by the description in the Introduction of some of the earlier material: “Lagrangian theory on fibre bundles is adequately formulated in algebraic terms of the variational bicomplex of exterior forms on jet manifolds. ...Cohomology of this bicomplex provides the global first variational formula for Lagrangians and Euler-Lagrange operators, the first Noether theorem and conservation laws in a general case of supersymmetries depending on derivatives of fields of any order.”

In later chapters there are useful presentations of gauge theories on principal bundles, gravitation theory on ‘natural bundles’, spinor fields, and topological field theory, as well as some original topics. The appendices helpfully gather together some brief surveys of key mathematical topics.

The book provides interesting insights into some of the rich geometry underpinning field theory for those already familiar with the classical theory from a more conventional standpoint. What it does not do, and to be fair, does not really try to do, is to explain the physical context in depth nor to draw any substantial conclusions about the quantization problem.

Reviewer: [N. M. J. Woodhouse \(Oxford\)](#)

MSC:

- [81-02](#) Research exposition (monographs, survey articles) pertaining to quantum theory
- [81Txx](#) Quantum field theory; related classical field theories
- [53-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to differential geometry
- [53Z05](#) Applications of differential geometry to physics

Cited in **14** Documents

Keywords:

[classical field theory](#)