

# Mathematical Methods of Modern Physics

Prof. Dr. Bernd Rosenow, SS 2024

**For:** Bachelor: Physics (6. semester) & IPSP (6. semester).  
Master: Physics & IPSP & Mathematical Physics

**Workload:** 5 LP, 1 lecture (English) + 1 tutorial (English) per week

**Exam:** 1 exam (90 min), prerequisite is 50% of the points from the weekly exercise sheets

## Contents:

- Complex analysis:

- Holomorphic functions

$$f'(z_0) = \frac{df(z)}{dz} \Big|_{z_0}$$

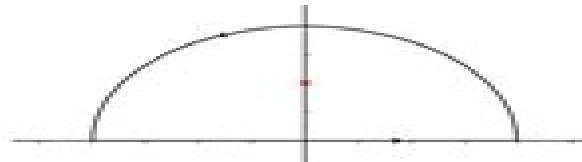
- Residue theorem

$$\oint_{\gamma} f(z) dz = 2\pi i \sum_k \Gamma(\gamma, a_k) \operatorname{Res}(f, a_k)$$

- Laurent series

$$f(z) = \sum_{n=-\infty}^{\infty} b_n z^n$$

- Applications to real integrals



$$\int_{-\infty}^{\infty} \frac{1}{x^2 + 1} dx = 2\pi i \frac{1}{2i} = \pi$$

- Distributions and Fourier transformation

$$G^<(k, E) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \frac{1}{2\pi} \frac{e^{-ikx} e^{iEt}}{x - vt - i\delta} dx dt = 2\pi i \delta(E - vk) \Theta(-vk)$$

- Eigenvalues and eigenfunctions

# Methods Of Modern Mathematical Physics

**Michael Reed, Barry Simon**

## Methods Of Modern Mathematical Physics:

**Methods of Modern Mathematical Physics: Functional analysis** Michael Reed, Barry Simon, 1980 This book is the first of a multivolume series devoted to an exposition of functional analysis methods in modern mathematical physics. It describes the fundamental principles of functional analysis and is essentially self contained although there are occasional references to later volumes. We have included a few applications when we thought that they would provide motivation for the reader. Later volumes describe various advanced topics in functional analysis and give numerous applications in classical physics, modern physics and partial differential equations.

Publisher description **II: Fourier Analysis, Self-Adjointness** Michael Reed, Barry Simon, 1975 Band 2

**Methods of Modern Mathematical Physics** Michael Reed, 2012-12-02

Methods of Modern Mathematical Physics Volume I Functional Analysis discusses the fundamental principles of functional analysis in modern mathematical physics. This book also analyzes the influence of mathematics on physics such as the Newtonian mechanics used to interpret all physical phenomena. Organized into eight chapters this volume starts with an overview of the functional analysis in the study of several concrete models. This book then discusses how to generalize the Lebesgue integral to work with functions on the real line and with Borel sets. This text also explores the properties of finite dimensional vector spaces. Other chapters discuss the normed linear spaces which have the property of being complete. This monograph further examines the general class of topologized vector spaces and the spaces of distributions that arise in a wide variety of physical problems and functional situations. This book is a valuable resource for mathematicians and physicists. Students and researchers in the field of geometry will also find this book extremely useful.

Methods of Modern Mathematical Physics Michael Reed, Barry Simon, 1972

**Methods of Modern Mathematical Physics** Michael

Reed, Barry Simon, 1972

Methods of Modern Mathematical Physics Michael Reed, Barry Simon, 1972

**Methods of**

**Modern Mathematical Physics, Vol. 1: Functional Analysis** M. Reed, 1980

**Methods of Modern Mathematical**

**Physics** Michael Reed, Barry Simon, 1972

Methods of Modern Mathematical Physics Michael Reed, Barry Simon, 1980

**Methods of Modern Mathematical Physics, Vol. 1: Functional Analysis** Michael Reed, 1980

**I: Functional**

**Analysis** Michael Reed, Barry Simon, 1981-02-23 This book is the first of a multivolume series devoted to an exposition of functional analysis methods in modern mathematical physics. It describes the fundamental principles of functional analysis and is essentially self contained although there are occasional references to later volumes. We have included a few applications when we thought that they would provide motivation for the reader. Later volumes describe various advanced topics in functional analysis and give numerous applications in classical physics, modern physics and partial differential equations.

**Methods of Modern Mathematical Physics** Michael Reed (joint author), 1972

**Methods of Modern**

**Mathematical Physics: Scattering theory** Michael Reed, Barry Simon, 1972

**Methods of Modern Mathematical**

**Physics** Michael Reed, 1972

Methods of Modern Mathematical Physics Michael Reed, Barry Simon, 1908

**Methods of Modern Mathematical Physics.II, Fourier Analysis, Self-adjointness** Michael Reed,Barry Simon,1972

**Methods of Modern Mathematical Physics** Michael Reed,1972      Methods of Modern Mathematical Physics Michael Reed,Barry Simon,1972

**Methods of Modern Mathematical Physics. Volume 1: Functional Analysis** ,1972

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