Perturbative and Constructive Renormalization: An Overview

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Abstract

These notes are a survey of the material treated in a series of lectures delivered at the Xth Summer School *Jorge André Swieca*. They are concerned with renormalization in Quantum Field Theories. At the level of perturbation series, we review classical results as Feynman graphs, ultraviolet and infrared divergences of Feynman integrals, Weinberg's theorem and Hepp's theorem, the renormalization group and the Callan-Symanzik equation, the large order behavior and the divergence of most perturbation series. Out of the perturbative regime, as an example of a constructive method, we review Borel summability and point out how it is possible to circumvent the perturbation diseases. These lectures are a preparation for the joint course given by Professor V. Rivasseau at the same school, where more sophisticated non-perturbative analytical methods based on rigorous renormalization group techniques are presented, aiming at furthering our understanding about the subject and bringing field theoretical models to a satisfactory mathematical level.

Keywords: Mathematical Physics, Constructive Euclidean Quantum Field Theory, Renormalization, Renormalization Group.

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