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Nota di contenuto	Introduction -- Reviews of Uncertainty Relations -- Classical Estimation Theory -- Quantum Estimation Theory -- Expansion of Linear Operators by Generators of Lie Algebra su(d) -- Lie Algebraic Approach to the Fisher Information Contents -- Error and Disturbance in Quantum Measurements -- Uncertainty Relations between Measurement Errors of Two Observables -- Uncertainty Relations between Error and Disturbance in Quantum Measurements -- Summary and Discussion.
Sommario/riassunto	In this thesis, quantum estimation theory is applied to investigate uncertainty relations between error and disturbance in quantum measurement. The author argues that the best solution for clarifying

the attainable bound of the error and disturbance is to invoke the estimation process from the measurement outcomes such as signals from a photodetector in a quantum optical system. The error and disturbance in terms of the Fisher information content have been successfully formulated and provide the upper bound of the accuracy of the estimation. Moreover, the attainable bound of the error and disturbance in quantum measurement has been derived. The obtained bound is determined for the first time by the quantum fluctuations and correlation functions of the observables, which characterize the non-classical fluctuation of the observables. The result provides the upper bound of our knowledge obtained by quantum measurements. The method developed in this thesis will be applied to a broad class of problems related to quantum measurement to build a next-generation clock standard and to successfully detect gravitational waves.