# A reformulation of Schwinger's action principle

# via Gâteaux variations

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In the first chapter, we examine the invariance property of the newtonian, lagrangian and hamiltonian methods of classical mechancis. The range of applicability of the lagrangian method and the role of the Legendre transformation are investigated in detail.

In the second chapter a quantization procedure based on the invariance property and Dirac's mechanics is shown to satisfy the properties of the present well known hamiltonian method of quantum mechanics for a particle on a riemannian manifold. When the same principle is applied to lagrangian mechanics, it is shown that the quantal Euler-Lagrange equations which are consistent with the Hamilton-Heisenberg equations differ from the classical form.

Accordingly, a radical change in the formulation of the (usual) $c$-number action principle of Schwinger is needed. Our main result in this field is in Chapter Four. This is achieved after an exposition (in Chapter Three) of certain ideas relating to the appropriate reformulation of the classical Hamilton Action Principle. It is for this reason that our quantal action principle in Chapter Four is referred to as the $q$-number Hamilton-Schwinger Action Principle. Both classical and quantal "variations" are regarded as Gâteaux variations which are explained in detail in this thesis.

The problems of deriving the canonical Poisson Bracket (respectively commutation) relations via the classical (respectively quantal) action principle are discussed. Our discussion leads to some criticism on

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previous authors, particularly Schwinger.  This is done in Sections 3E and 4C of Chapters Three and Four respectively.