

Republic of Iraq



جمهورية العراق  
وزارة التعليم العالي والبحث العلمي  
الجامعة المستنصرية  
كلية التربية

# الحلول العددية للمعادلات التفاضلية الأعتيادية التصادفية

رسالة  
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# ABSTRACT

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In this thesis we have three main objectives. The first objective is to study in details the theory of stochastic calculus and stochastic ordinary differential equations using the Itô and Stratonovich formulae , including the basic definitions and fundamental concepts related to this topic, as well as, studying the Itô-Taylor series expansion and its applications.

The second objective is to study the strong convergence (mean-square convergence) of some of the numerical methods for solving stochastic differential equations using stochastic linear multi-step methods and prove some results related to this topic.

The third objective is to study two and three steps Maruyama methods and Milstein methods, then introducing a modified approach to derive order  $\frac{1}{2}$  of two and three steps Maruyama methods as well as order  $h$  two step methods , with some new methods (to the best of our knowledge), this objective includes also the solution of SODE's using implicit methods which is solved using the methods of solving nonlinear equations resulting from the implicit methods which is solved by Newton-Raphson method.