DEDICATION

To the spirit of my father

To my mother

To my brothers and sisters

To my wife and son

ACKNOWLEDGEMENT

Firstly all thanks to Allah for blessing us , Special thanks to supervisor Dr. Emad Aldeen for helping me and thanks for everyone has helped me to complete this research.

ABSTRACT

The simplest class of linear dynamic are considered. We introduce a maximization principle useful for characterizing an optimal control. We discuss the connection with the Pontryagin Maximum Principle and we provides in brief the control of stochastic Differential equation by dynamic programming techniques in addition of some applications.

الملخــص

اعتبرنا فئة بسطه من الديناميكية الخطية . إذ قدمنا مبدأ تعظيم مفيد للتميز على التحكم الأمثل . ناقشنا الاتصال مع مبدأ الحد الأقصى لبون تريقين . و كذلك وفرنا باختصار سيطرة المعادلة التفاضلية العشوائية من خلال تقنيات البرمجة الديناميكية مع بعض التطبيقات.

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Controllability, bang-bang principle

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Optimal Control and Pontryagin Maximum Principle

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Introduction

In this research we consider the optimal control theory and organized it as follows:

• In chapter 1 , We introduce the simplest class of dynamics, those linear in both the state x(·) and the control α(·), and derive algebraic conditions ensuring that the system can be steered into a given terminal state. We introduce as well some abstract theorems from functional analysis and employ them to prove the existence of so-called "bang-bang" optimal controls.

• In chapter 2 , We continue to study linear control problems, and turn our attention to finding optimal controls that steer our system into a given state as quickly as possible. We introduce a maximization principle useful for characterizing an optimal control, and will later recognize this as a first instance of the Pontryagin Maximum Principle. our discussion of the Pontryagin Maximum Principle and its variants is at the heart of these notes.

• In chapter 3 , We explain that, the Dynamic Programming provides an alternative approach to designing optimal controls, assuming we can solve a nonlinear partial differential equation, called the Hamilton-Jacobi-Bellman equation. This chapter explains the basic theory, works out some examples, and discusses connections with the Pontryagin Maximum Principle .We discuss briefly two-person, zero-sum differential games and how dynamic programming and maximum principle methods apply.

• In chapter 4 , We provides a very brief introduction to the control of stochastic differential equations by dynamic programming techniques . The Itˆo stochastic calculus tells us how the random effects modify the corresponding Hamilton-Jacobi-Bellman equation.