الايـة

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قُل لَّوْ كَانَ الْبَحْرُ مِدَادًا لِّكَلِمَاتِ رَبِّي لَنَفِدَ الْبَحْرُ قَبْلَ أَن تَنفَدَ كَلِمَاتُ رَبِّي وَلَوْ جِئْنَا بِمِثْلِهِ مَدَدًا ﴿١٠٨﴾

صدق الله العظيم

سورة الكهف

DEDICATION

The words and measures can never express my deepest gratitude to my parents. They have been a force of strength all along, and without them it would have been an uphill task for me to complete this work.

Last but not the least, 1am deeply indebted to my brothers, sisters and my friends; their incessant support made me achieve new heights in life and built my character and career.

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Abstract

This study presents the design of the decoupled neural network reference compensation technique (DNNRCT). The technique is applied to the control of a two degrees-of-freedom inverted pendulum mounted on an x-y table. Neural networks are used as auxiliary controllers for both the X axis and Y axis of the PD controlled inverted pendulum. The DRCT method is used to compensate for uncertainties at the trajectory level and used to control both the angle of a pendulum and the position of a cart simultaneously.

المستخلص

هذه الدراسة تقدم تصميم تقنية التعويض المرجعية للشبكات العصبية المنفصلة . هذه التقنية طبقت من اجل التحكم فى البندول المعكوس ثنائى الحركة الحر على طاولة من محورين . الشبكات العصبية استخدمت كمتحكم ثانوى للمتحكم التناسبى االتفاضلى للبندول المعكوس الحر للمحورين X و Y . تقنية التعويض المرجعية للشبكات العصبية تستخدم لتعويض عدم التأكد عن مستوى المسار كما تستخدم للتحكم على وضع وزاوية البندول المعكوس الحر انيا.

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LIST OF SYMBOLS

SYMBOL	NAME
b	Friction of cart
e	Error
j	Moment of inertia for inverted pendulum
	Derivative gain
	Integral gain
	Proportional gain
L	Length of pendulum to the center of gravity
M	Mass of the cart
m	Mass of the pendulum
U	Force applied to the cart
	Pendulum angle with vertical

LIST OF ABBREVIATIONS

SYMBOL	ABBREVIATION
ANN's	Artificial Neural Networks
DRCT	Decoupled Reference Compensation Technique
FF	Feed Forward
IP	Inverted Pendulum
MARC	Model Reference Adaptive Control
MATLAB	Matrix Laboratory
MIMO	Multi Input Multi Output
PD	Proportional Derivative
PID	Proportional Integral Derivative
SISO	Single Input Single Output
STR	Self Tuning Regulator
2-DOF	Tow Degree of Freedom