

Dedication

I dedicate this research with much love and appreciation to my mother who has always been there for me, to my father who have taught me the carriage and confidence, to my brothers and sister who mean the world to me and finally to my friends, family, colleagues and teachers.

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Firstly, thanks to Allah, our creator above for being everything and for giving us the ability and strength to complete this research.

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Abstract

In the rapid development of flexible automation and the broad application of computer technology, industrial monitoring software has played an integral role in all kinds of industrial areas. It allows operators to monitor and control a plant in real-time with feedback from any number of processes.

In this study, the primary objective is to develop the boiler turbine system model in Khartoum north power station. The challenge in controller design for these plants exists because they are typically nonlinear and multi-variable with multiple control objectives. This thesis presents the application of a fuzzy logic based controller for boiler turbine plant to control the drum pressure, power output and water level. Fuzzy control systems have been successfully applied to a wide variety of practical problems. It has been shown that these controllers may perform better than conventional controllers especially when applied to processes difficult to model, with nonlinearities, and when there is heuristic knowledge from human operators.

The scopes include the modeling, designing and simulation of boiler turbine, conventional controller PI and fuzzy controller. The models are carried out using MATLAB/SIMULINK. The simulation results demonstrate that performance of fuzzy logic controller is better.

المستخلص

في التطور السريع لأتمتة المرنة والتطبيق الواسع لتكنولوجيا الحاسوب لعبت برمجيات العرض الصناعية دوراً كبيراً في جميع المجالات الصناعية. الأمر الذي يمكن المشغلين من مراقبة وضبط المحطة في الوقت الحقيقي مع وجود تغذية راجعة من أي عدد من العمليات. الهدف الرئيسي من هذا البحث هو تصميم نظام تحكم آلي لمحطة بحري حرارية. ويكمن التحدي في تصميم نظام تحكم لهذه الوحدات بسبب انهماك خطية ومتعددة المتغيرات وذات أهداف تحكم متعددة. يقدم هذا البحث تطبيق وحدة تحكم منطق غامض للمرجل التوربيني للتحكم في ضغط الاسطوانة والقدرة الخارجة مستوى المياه. وأنظمة التحكم الغامضت بقت بنجاح على مجموعة واسعة من المشاكل العلمية وقد أثبت أن أداء هذه المتحكمات أفضل من المتحكمات التقليدية، وخصوصاً عندما تُطبق على عمليات ذات طبيعة لا خطية مع صعوبة إيجاد النموذج لها، وعندما يكون هناك حوجة للخبرة المعرفية للعاملين. ويشمل النطاق النمذجة وتصميم ومحاكاة للمرجل التوربيني والمتحكم التناسبي-التكاملي التقليدي والمتحكم الغامض. تم تنفيذ النماذج باستخدام MATLAB/SIMULINK. وأثبتت نتائج المحاكاة أن أداء المتحكم الغامض هو الأفضل.

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ABBREVIATIONS

ASME	American Society of Mechanical Engineers
CE	Change in Error
D	Derivative
E	Error
FIS	Fuzzy Inference Systems
FLC	Fuzzy Logic Controller
GUI	Graphical User Interface
I	Integral
MIMO	Multiple Input and Multiple Output
MISO	Multiple Input and Single Output
P	Proportional
PC	Personal Computer
PI	Proportional Integral
PID	Proportional Integral Derivative
R	Reference

SYMBOLS

μ_A	Membership function
k_d	Derivative gain
k_i	Integral gain
k_p	Proportional gain
k_u	Ultimate gain
T_u	Oscillation period
U	Control signal
Y	Actual output