بسم الله الرحمن الرحيم

HOSSAM MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

HOSSAM MAGHRABY

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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بعض الوثائق
الأصلية تالفة

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شبكة المعلومات الجامعية

بالرسالة صفحات

لم ترد بالأصل

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ADVANCED CONTROL METHOD APPLIED TO CEMENT INDUSTRY

A THESIS
Submitted for M. Sc. Degree in
Automatic Control Engineering
By

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Abstract

A Master Thesis of

Advanced Control Method Applied to Cement Industry

By
Mohamed Hamdy Mohamed El-Sayed
(B.Sc.)

A mathematical model of heat transfer around the preheater tower in dry process in cement industry has been developed. A description of automatic control system of the preheater-kiln process by using fuzzy control is given. The model describes the energy balance of each preheater stage. Relevant temperatures of the preheater tower (gas and dust) as well as those inside the cyclone (unmeasured) can be attained via this model. In addition, cyclone clogging diagnosis has been undertaken using two types of the advanced control. The first is the fuzzy controller which can reach the normal temperature values inside the cyclones with a minimum material feed. The second is the clog removal expert system which avoids the occurrence of clogging faults early. A dedicated expert diagnosis system presents to enhance the performance of the preheater tower by detecting the position of the prime clog early and select the proper solution to remove it by means of direct air cannons at the place of the prime clog only (not all cannons), and adjust the bypass ratio of the kiln gas automatically

NOTE ON PUBLICATION

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Paper title: Modeling and Fuzzy Control of the Preheater-Kiln Tower in Dry Process of Cement Industry

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ABBREVIATIONS

SP	Suspension preheater process
SF	(Suspension preheater (SP) with Flash Furnace (FF)) process
SISO	Single input-Single output system
FLC	Fuzzy logic controller
CRES	Clog Removal Expert System

LIST OF SYMBOLS

ε	Volatility of raw mix alkalis
V	Alkali valve =Bypass volume
K	Circulation factor
R_c	Residual content in the clinker
ΔQ_1	Heat carried in by fluid flow
ΔQ_2	Heat carried over to the next section
ΔQ_3	Heat transferred from the wall
ΔQ_4	Heat stored in the fluid
C	Heat capacitance of fluid per unit length
θ	Fluid temperature, assumed uniform in all transverse sections
v	Velocity of flow, assumed constant and uniform in a transverse section
R	Surface resistance per unit length
ϕ	Wall temperature
τ	Dimensionless time
η	Dimensionless distance
ℓ	Total length of heat transfer line
L	Dead time
a	Dimensionless constant
C_h	Heat capacitance of a hot gas per unit length
C_c	Heat capacitance of a cold raw meal per unit length
υ_h	Velocity of hot gas phase inside gas duct and cyclone

υ_c	Velocity of cold raw meal phase inside gas duct and cyclone
θ_h	Temperature of the hot gas phase
θ_c	Temperature of the cold raw meal phase
L_h	Delay of the hot phase (gas)
L_c	Delay of the cold phase (raw meal)
a_h, a_c	Dimensionless constants
D	Time derivative in the nondimensional time domain $\partial / \partial t$
r	Delay ratio between two flows
θ_{h1}	Gas temperature inlet
θ_{c1}	Raw meal temperature inlet
θ_{h2}	Gas temperature outlet
θ_{c2}	Raw meal temperature outlet
m_{feed}	Rate of raw meal feed
T_{gi}	Gas temperature outlet from cyclone (i)
T_{di}	Raw meal temperature outlet from cyclone (i)
K_g	Gain of the first order system
T_g	Time constant
E_{in}	Input energy
E_{out}	Input energy
m	Mass flow rate of the material
C_p	Specific heat of the material
K_i	Fraction value for each cyclone stage
$(m_x)_i$	Mass of the mixture inside cyclone *i*
$(C_{px})_i$	Specific heat of the mixture inside cyclone *i*
$(T_x)_i$	Temperature of the mixture inside cyclone i
$(m_g)_i$	Mass of the gas exit from cyclone i
$(C_{pg})_i$	Specific heat of the gas exit from cyclone i
$(m_d)_i$	Mass of the raw feed exit from cyclone i
$(C_{pd})_i$	Specific heat of the raw feed exit from cyclone i

i	Integer number = 1, 2,…, 7
T_{ref}	Reference temperature
E	Error between the desired and process O/P
CE	Change of error between two samples
U_f	Fuzzy value of rate of feed
U_o	Crisp value of rate of feed
T_{out}	Output temperature
$\mu_c(u)$	Membership function
V1	Preheater valve
V2	By-pass valve

LIST OF FIGURES