Encoding research on the failure of fan in the era of big data

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Keywords: Fault encoding;Fan connected to grid;Fault code;Express uniquely. **Abstrat**: with the development of wind power industry,the numberof wind turbines connected to grid is increasing,so the inevitable question follows,especially the fault information.In view of the difficulty in locating the accurate position of wind turbine failure, a new wind turbine fault encoding method is proposed according to the installing position and fault type.They are given an unique identification.When the fan is in failure,we can locate the wind turbine fault quickly and accurately according to the code,ensuring the safe and efficient operation of the wind turbine.The results show this method has some guidance for the diagnosis and early warning of wind turbine fault.

Introduction

Wind energy is konwn as a renewable clean energy in the world, the resources are particularly rich in vast china. In the domestic ,wind power grid connected continues to increase. There are thousands of operating data from wind turbines that need to be processed every day, especially the fault information. In order to make the managers and users can retrieve and locate the fault more quickly and improve the leve of standardized management of wind farm , it is imperative to encoding the different fault from the different wind fan in the different farm. Encoding the fault uniquely can realize the only correspondence between the fault and spare parts and realize the accurate location of the fault in the operation of the wind turbine. It can accurately establish the connection between fault and spare parts and solve the problem of the fault of the wind turbine, ensuring the efficient operation of the wind turbine. At the same time, it is also benificial for managements of the wind field to analyze the different types of fault generatted by different fans and establish the foundation for the whole life cycle management of the wind turbine equipment.

Structure of wind turbine

Fan is an important part of the wind farm.it is mainly consist of Impeller, Yaw system, Mechanical transmission system, Electronic control system, Generator, Hydraulic system, Tower and foundation and Windfinding system The structure diagram of the wind turbine is shown in figure 1:



Figure 1 Structure diagram of fan

Encoding rules for fans

In order to locate the fault position of wind turbine accurately, encoding the position and structure of wind turbine uniquely is necessary. The encoding rules are part of the national standards and industry standards.

Position of the wind field encoding

Some group companies may have multiple wind farms in many countries. In order to locate the unique position of each wind farm ,taking the encoding readability into consideration, we use 9 bit to express the code with the first letter of their name. The code is consist of Wind farm identification code, Enterprise code, Country code, Area code and 2 digit serial number. Among them the Wind farm identification code is "F", Wind power project identification code is "P", Item company logo Code is "C", the wind farm position encoding rule is shown in table 1:

First place	2-3 position	4-5 position	6-7position	8-9 position			
Wind farm identification code (F)	First letter of English word of enterprise	Country code	Provincial code	The 2 digit serial number			
A	AA	AA	AA	NN			

Table 1 Position encoding rule table

In order to describe the encoding method more specificly and vividly, take Longyuan item company as example. The Sample is shown in table 2 :

Wind farm name	First place	2-3 position	4-5 position	6-7 position	8-9 position	Encoding results
Tongyu wind farm of Jilin Province	F	LY	CN	JL	01	FLYCNJL01
Dove wind farm	F	LY	CA	AB	01	FLYCAAB01

Table 2 Encoding example of wind farm

Wind farm system type encoding

In order to locate the position of wind field equipment such as fan, boost station, box transformer substation, transmission lines, wind tower and encode the equipment uniquely,we quote VGB-S-823-T32 to encode the each system of wind farm with 1 bit length is type. The encoding principle of wind farm system is shown in table 3 and the sample is shown in table 4:

table 3	encoding	princi	ple of	wind	farm system	1
	<u> </u>					

First place(A total of one)
Express with letter
А

Category name	System code
Fan	F
Transmission line	S
Boost station	Y
Wind tower	С
Box transformer substation	X
Other	Q

	able 4	Wind	field	system	type	code	table
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Structure of wind turbine encoding

In order to be able to locate the fault position accurately.Structure classification is necessary to the fan system.We reference VGB-S-823-T32 and patrol inspection standard of Longyuan wind

machine to encode each category of fan, in addition the standard is improved and pefect. The encoding principle of structure of fan system is shown in table 5, the sample is shown in table 6:

table 5 encoding principle of structure of fan system	
First place(A total of one)	
Letter representation	

······································
First place(A total of one)
Letter representation
А
Letter representation A

table 6 encoding sample of structure of fan system					
Code	Name of fan structure classification				
А	Tower and foundation				
В	Yaw system				
С	Mechanical transmission system				
D	Generator				
Е	Hydraulic system				
F	Electronic control				
G	Impeller				
J	Variable pitch system				
K	Windfinding system				
Т	Other				

c c

Fault type of fan encoding

In order to judge the running state of fan and the sub healthy state, As well as the statistics of the warning information of fans. We need to encode the different kinds of faults. It is convenient to encode the fault with 11 bit, it consists of Wind farm system classification code, Fan system code, Subsystem code, Parts / accessories code, Alarm type code, Measurement code and Serial number.Encoding principle of fault is shown in table 7:

Structure code of wind turbine(2-5position)						10-11	
First place	Second	Third	4.5 position	nosition	8-9 position	nosition	
	place	place	4-5 position	position		position	
Wind farm	Fan system	Subsystem	Parts	Alarm	Measureme	Serial	
system	code	code	accessories	type	nt code	number	
code	code	code	Code	code	ni code	number	
А	А	А	NN	NN	NN	NNN	

Table 7 Rule table of fault code for wind turbine

In the fault code, the principle and explanation of alarm type and measurement is respectively shown in table 8 and table 9:

aada	Alorm tuno	Eveloin	Sampla
code	Alarin type	Expiain	Sample
		The value measured or	The power of yaw
01	Out of limit	calculated exceeds the	system reach the error
		alarm limit value	limit
		Contains sensor fault and	
02	Sensor fault	the loss of feedback	
		signal	
		Communication failure	
03	Communication failure	between master control	
		and fan system	
		Operation or action is not	
04	Orat of control	Operation of action is not	
04	Out of control	in accordance with the	
		master or manual order	
05		Disconnect from power	
05	The loss of power	supply	
		Master control program	
06	Software fault	and variable pitch	
		software fault	
		Fault that do not belong	
07	Other faults	to the above classification	
		to the above classification	

Table 8Description of alarm type

Table 9Description of measurements

code	Measurement	Sample
01	Temperature	The temperature of No.3 variable paddle cabinet is too high
02	Power	The power of yaw system reach the error limit
03	current	The current of Variable pitch motor is too large
04	Voltage	Variable pitch over voltage warning
05	Position	Left yaw reach limit
06	time	Running time of yaw motor is too long
07	direction	yaw direction is wrong
08	speed	The speed of yaw system is too slow.

The application of encoding in the actual fault of fan

In the actual operation of fan, at present, each fan manufacturers have their own fault code. The description of same type of fault is different to each manufacturer. It is very difficult to manag. According to this encoding method, longyuan group have their fan fault encoded. The part of code is shown in table 10:

Table 10	Part of longyuar	ı yaw	system	fault enc	coding	
						_

	Wind field	Fan structure				Maggurama	
	system	system	Subsystem	Parts/ accessories	Alarm type	nt	Fault name
Fault 1	Wind turbine	Yaw system	Yaw motor	Yaw counter	The more limited	time	Yaw directional timeout
code	F	В	А	03	01	06	
Fault 2	Wind turbine	Yaw system	Yaw motor		The more limited	temperature	Yaw motor overheating
code	F	В	А	00	01	01	FBA00010 1

It is clear in the table that this encoding rule is comprehensive to various fault types of yaw system of fan, as well as show the specific position and type of fault. It is also convenient for managers to deal with the statistical information and find out the fault timely and efficiently.

Summary

In the era of big data, the operating information of fans is changing. and the fault is becoming more complex. Locationg the specific position clearly and quickly has become an urgent. In this paper, we encode the fault according to the position and structure of fan, making it possible to locate the accurate position of faults. The advantage of this method lies in that we can directly determine the installation position through the fault type, it is also convenient for management to manage the spare parts, improving the working efficiency. It shows that this method has certain economic benefits for the whole operation of fan.

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