東方雲氣評論

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東方電氣評論

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2021

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1. مجد مص 2. 611731 بحي ئه ئج نشخ 150001 ئج بحي ئه
3. مجد مص 4. مجد مص 511455 611731

102.410 Hz 77.349 Hz

74.711 Hz

2 1%

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TL364 ئؤ A ى 1001-9006 2021 01-0001-04

Modal Test and Simulation of Nine-tube Prototype of Liquid Sodium Heat Exchanger

PENG Fan[1], *WANG Liwen*[1], *ZHENG Wu*[2], *ZHANG Shengyu*[2], *LIAO Baifeng*[3], *CAO Xuefan*[4]

(1. DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China; 2. Harbin Institute of Technology, 150001, Harbin, China;
3. Dongfang Electric (Guangzhou) Heavy Machinery Co., Ltd., 511455, Guangzhou, China;
4. Dongfang Electric Co., Ltd., 611731, Chengdu, China)

Abstract: The dynamic characteristics of the heat exchanger are closely related to the safety performance and operating efficiency of the nuclear power plant. In order to assess the fluid-induced structural vibration, a modal test through a nine-tube prototype is conducted to obtain the natural vibration characteristics of the heat exchange tube in the air and water environment. The fundamental frequencies of the heat exchange tubes in the air and water environment are 102.410 Hz and 77.349 Hz respectively, and the correction value of the fundamental frequency of the heat exchange tubes in the liquid sodium derived by the above experiment data is 74.711 Hz; finally, the high reliability of the test results is verified by the finite element analysis, the relative error of the first two natural frequency results of the test and simulation calculations is within 1%, and the simulation analysis results are important references in the structural design and optimization stage.

Key words: liquid sodium heat exchanger; heat exchange tube; modal test; simulation

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2017YFF0107300

1995 – 2019

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1.1

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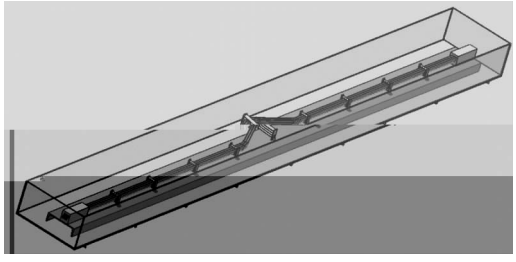


1

1.2 ضم مدد نج

1 ئۆ نج ئۆ شد

1	48	AD 24 24 102.4 kHz	
2	32	1 mV·m^{-1}·s^{-2} 2 ~ 10 000 Hz	500 g 1.2 g
3	1	0.199 mV·N^{-1} 40 kHz	25 000 N ±2%

1.3

2

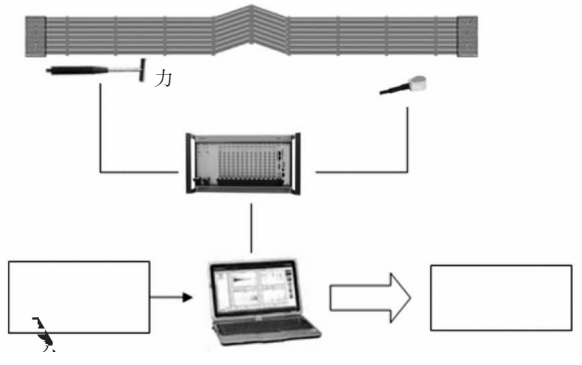
48

1

10

3 3

1 4 12



2 نج

3 يخ وسلم ضم مدد نج

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16

4

5 3

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32

1

1 C_M 2

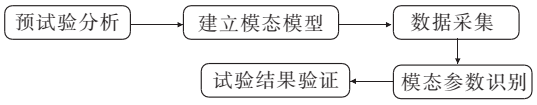
6

$$f\sqrt{\frac{m_t}{EI}}=f\sqrt{\frac{m_t+m_i+m_0}{EI}} \quad (1)$$

$$f\sqrt{\frac{m_t}{EI}}=f\sqrt{\frac{m_t+m_{iNa}+m_{0Na}}{E_TI}} \quad (2)$$

$m = m_t + m_i +$

m_0 m_t kg/m m_i



4

2

2.1

5

2

1 102.410 Hz 77.349 Hz

ئو 2 ئو ي

	/Hz	/%	/Hz	/%
1	102.410	2.012	77.349	6.886
2	115.476	2.107	86.364	4.836
3	125.120	3.159	113.612	3.623
4	131.726	1.386	125.582	2.143
5	141.214	4.111	131.533	2.836
6	150.679	2.051	142.661	1.656
7	160.724	1.107	157.146	1.614
8	176.665	1.620	166.496	1.465
9	184.608	1.768	173.697	1.415
10	189.679	0.775	179.295	1.678

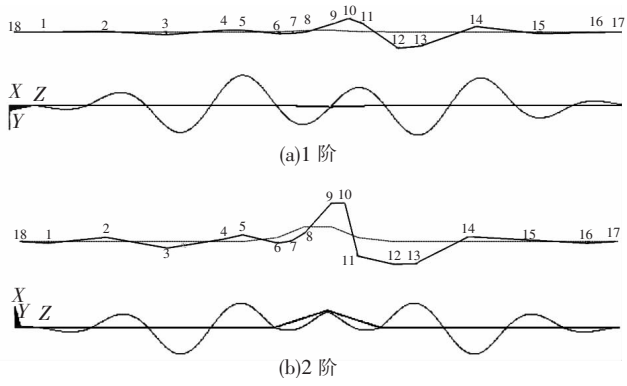
2.2

ئو 4 شمخ ي

	Hz	Hz	%	Hz	Hz	%	Hz	Hz	%
1	102.410	102.940	0.51	77.349	77.159	0.25	74.711	75.180	0.62
2	–	108.320	–	–	81.188	–	–	78.503	–
3	–	108.860	–	–	81.596	–	–	78.897	–
4	115.476	113.060	2.14	86.364	84.741	1.92	83.365	81.938	1.74
5	125.120	127.050	1.52	–	95.229	–	–	94.488	–
6	131.726	137.060	3.89	–	102.730	–	–	99.332	–
7	141.214	139.650	1.12	–	104.670	–	–	101.210	–
8	150.679	151.140	0.31	113.612	113.280	0.29	108.779	109.530	0.69
9	160.724	155.630	3.27	–	116.650	–	–	114.080	–
10	–	164.500	–	125.582	123.300	1.85	121.441	119.220	1.86

= | – |/ ×100%

6



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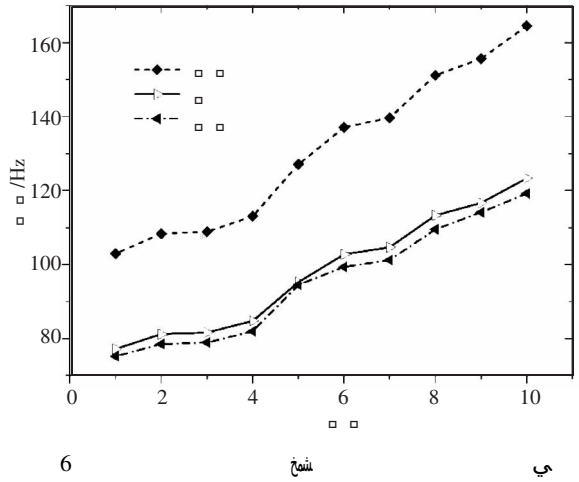


6 شمخ ي

7

3

1

102.410 Hz 77.349 Hz

74.711 Hz

2

2 1%

8

611731

X53 A 1001-9006 2021 01-0005-04

Analysis of Soil Remediation Technology

TIAN Jian, WU Jiahua, HU Chunyun, XIE Fei, ZHANG Yuan

(DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China)

Abstract: This article mainly introduces the current situation of soil pollution and the market capacity of soil remediation in China, summarizes the main existing soil remediation technologies at home and abroad, and evaluates and compares these methods. The future development of soil remediation is also prospected in this article.

Key words: soil pollution; soil remediation; heavy metals; organic pollutants

1

2014

16.1%

2

2.1

2.1.1 / Solidification/Stabilization S/

[1] 2017 S

151.45 2018 S/S [2] S/S

270

2024

860 S/S

2020-06-22

1993- 2019

S/S MPE

3

S/S

/ S/S

2.1.2 /

/ 3

/

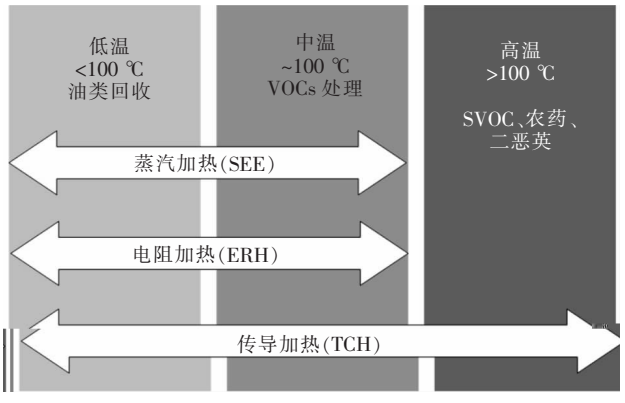
PAHs

/

ERH TCH

SEE 3

1



1 ضخ شفخ وسلم

2.1.3 /

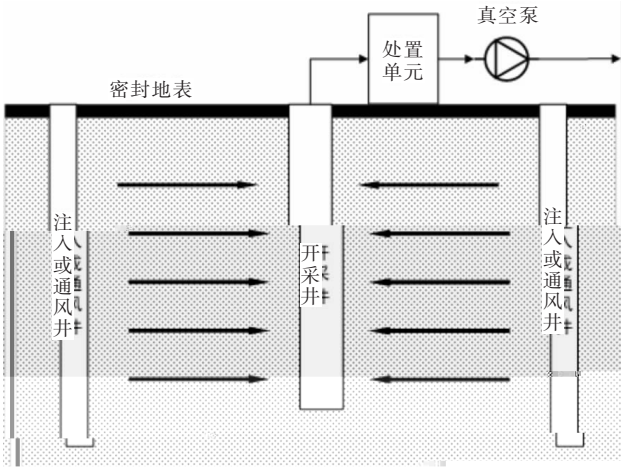
Soil Vapor Extraction SVE

/

SVE

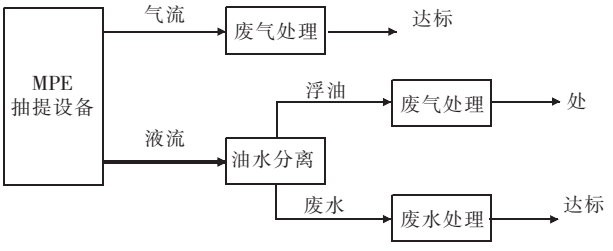
2

Multi-Phase Extraction MPE



地下水

2 عه



3 MPE نه يخ

SVE/MPE

2. 2

2. 2. 1

[5]

2. 2. 2

SO_2 H_2S Fe^0

2. 2. 3 [6]

SVE

2. 3

2. 3. 1

Al pH

Al^{3+} Al Al

2. 3. 2

[7]

2. 3. 3

2. 4

+

2. 5 ي

1

3

نخ

ي 1 ؤ

		/ ·t^{-1}
/	/	200 ~ 800
/	/	400 ~ 500
/ SVE MPE		SVE 100 ~ 300 MPE SVE
		400 ~ 500
		150 ~ 500
	/	300 ~ 1 500
		500 ~ 1 500
	/	500 ~ 1 500 400 ~ 1 900
		100 ~ 500
		300 ~ 400
		100 ~ 200

J . 2019 5 245 2

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1 . J .
2019 1 47 – 50

2 . /

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1.0 ~ 1.5 V 2

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TM911.4 A 1001-9006 2021 01-0009-04

Study on the Effect of Cracks in Catalyst Layer on the Durability of PEMFC Membrane Electrode Assembly

XIE Guangyou[1], *ZHU Leifeng*[2], *LI Ting*[2]

1. Dongfang Electric (Chengdu) Hydrogen Fuel Cell Technology Co., Ltd., 611731, Chengdu, China;

2. Sichuan Key Laboratory of Long-life Fuel Cells, 611731, Chengdu, China)

Abstract: Cracks are easily generated in catalyst layer due to the thermal stress between surface and inside during catalyst ink coated on membranes. Catalyst layer containing cracks in different degree of severity are prepared in this paper. The effect of cracks on the durability of membrane electrode assembly is studied by the accelerated durability test. After 1 000 cycles of potential scanning between 1.0 ~ 1.5 V, compared with CCM containing no cracks, the decay rate of the performance electrode with networked cracks increases by two times, and the decay rate of ECSA is double.

Key words: PEMFC membrane electrode assembly; catalyst layer; cracks; durability

Proton Exchange catalyst coated Membrane Fuel Cell PEMFC membrane CCM gas diffusion 95% [1] electrode GDE ② decal 21 process [5] –

[2]

3 – 4

①

2020 – 09 – 28

1983 – 2011

6

X FE-SEM

7

TESCAN VEGA3

2

3

3

2. 1

1 000 2 000 CL-N CL-I CL-Y 0.1 1.0 A/cm^2

1 0.1 1.0 A/cm^2

1.0 A/cm^2 2 000 CL-N I CL-I 1 Y CL-Y 2

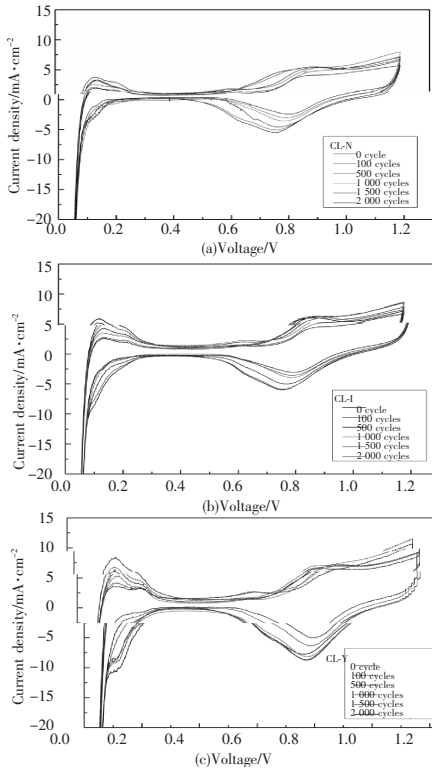
ئو 1 CL-N CL-I CL-Y شمخ

Sample		CL-N		CL-I		CL-Y	
Cycle number		1 000	2 000	1 000	2 000	1 000	2 000
Degradation Rate/%	0.1 A/cm^2	3.48	4.97	3.72	5.46	13.10	21.36
	1.0 A/cm^2	13.57	25.27	17.99	52.67	23.72	>70

2.3 مجه

CL-N CL-I CL-Y 3 *ECSA*

ESCA 4



4 CL-N CL-I CL-Y شمخ ° جي ´ شمخ

3 *ECSA* 100 1 000 2 000 *ECSA* 2 3 *ECSA* 1 000 CL-N I CL-I *ECSA* 77.7% Y CL-Y *ECSA*

ئو 2 CL-N CL-I CL-Y مجه شمخ *ECSA*

Sample		CL-N	CL-I	CL-Y
ECSA Degradation Rate /%	100 cycles	4.93	16.79	15.84
	1 000 cycles	25.62	45.54	53.91
	2 000 cycles	46.31	52.28	65.02

3

2 1

كا

1 . — M . 2003

2 . M . 2010

3 Frisk JW Hicks MT Atanaski RT et al. MEA Component Durability R . Office of Scientific & Technical Information Technical Reports 2004

4 Li X Sabir I. Review of bipolar plates in PEM fuel cells Flow-field design J . International Journal of Hydrogen Energy 2004 30 4 359 – 371

16

50 MVar

618000

50 MVar

TM621 A 1001-9006 2021 01-0013-04

The Design Research of 50 MVar Distributed Synchronous Compensator's Lubricating Oil System

HUANG Guowei, XUE Changkui, LI Yong

(Dongfang Electric Machinery Co. , Ltd. , 618000, Deyang, Sichuan, China)

Abstract: According to the layout environment and safe operation requirements of the 50MVar distributed synchronous compensator, this paper researches the design of synchronous compensator's lubricating oil system and calculates the tank capacity of the lubricating oil system, the flow and pressure of the lubricating oil pump, and the heat exchange area of the oil cooler, which provides a theoretical basis for the selection of system equipment.

Key words: distributed synchronous compensator; lubricating oil system; flow and pressure of the lubricating oil pump; tank capacity; exchange area

300 MVar

1

50 MVar

2 1

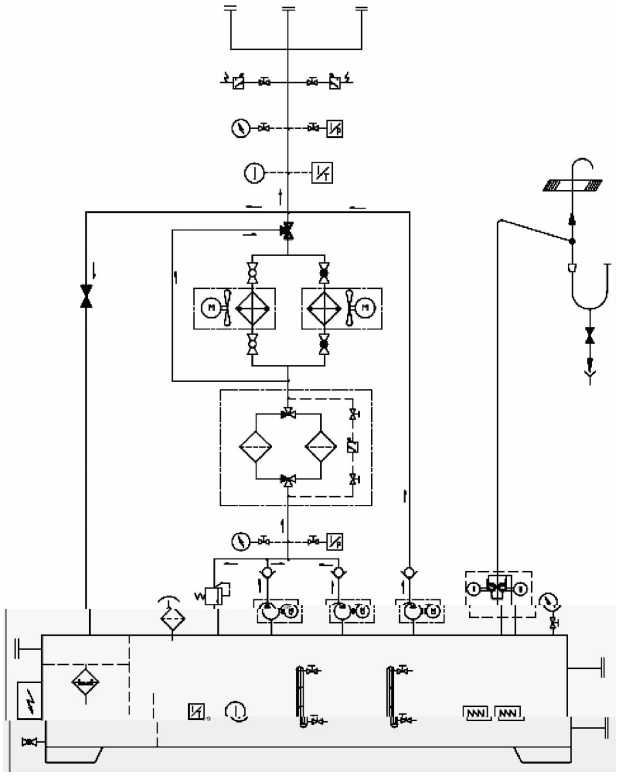
1 1 1

2020 - 06 - 22

1987 - 2010

1987 - 2012

2



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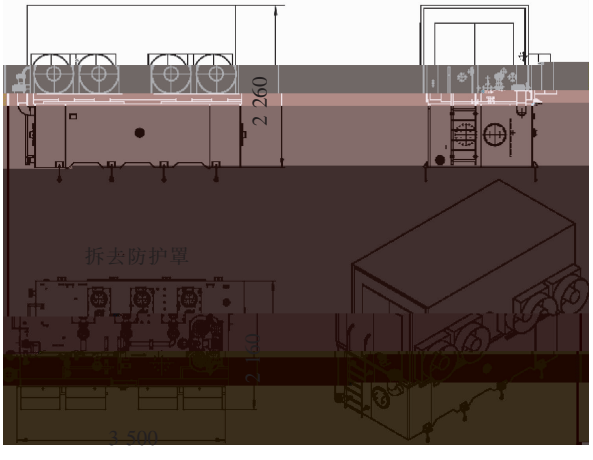

2

1

2

1

	kW	P	68
	kW	H	20
	min	t	40
	℃	T_0	30
	℃	T_1	40
	℃	T_2	55
	℃	T_3	75
	MPa	P_1	0.1

2.1

32#

$$Q = \frac{P}{C\rho\Delta T_1} \quad (1)$$

ρ 886 kg/m^3 C

1.92 kJ/kg℃ ΔT_1

$\Delta T_1 = T_2 - T_1$℃

159 L/min

5 r/min

160 L/min

2.2

2

2

			90°		
	d/mm	l/m			
	50	30	6	1	6
	32	15	4	0	0

2.2.1

$$Re = \frac{vd}{\gamma} = \frac{1.274Q}{\gamma l} \times 10^4 \quad (2)$$

Q 160 L/min

80 L/min γ 0.32 St

Re_1 = 2 123

$Re_1 = 1\ 659$ $Re_L = 2\ 320$

1

2. 2. 2

$$\Delta P_L = \lambda \frac{l}{d} \times \rho$$

C kJ/kg·℃ G

$G = Q\rho/A_e$ kg/m²·s Q

m³/h St $St = j/Pr^{2/3}$ j

Re j-Re

[4] Pr $Pr = \mu C/\lambda$ Re

$Re = GD_e/\mu g$ μ 1.88×10^{-5} Pa·s 2.83×10^{-3} Pa·s λ

0.025 W/K·m 0.15 W/K·m ρ kg/m³ g 9.8 m/s²

$\alpha_1 = 12\ 78$ kJ/m²·h·℃ $\alpha_2 = 415$ kJ/m²·h·℃

4.3.2

$$\eta = 1 - \frac{F_{o2}}{F_o}(1 - \eta_f) \quad (11)$$

η_f $\eta_f = \tanh ml/ml$ m

$m = \sqrt{2\alpha/\lambda_m\delta}$ l

$l = h_1$ $l = h_2/2$ λ_m

735 kJ/m²·h·℃

$\eta_1 = 0.772$

$\eta_2 = 0.978$

4.3.3

$$K_1 = \frac{1}{\frac{1}{\alpha_1\eta_1} + \frac{1}{\alpha_2\eta_2}\cdot\frac{F_1}{F_2}} \quad (12)$$

$$K_2 = \frac{1}{\frac{1}{\alpha_2\eta_2} + \frac{1}{\alpha_1\eta_1}\cdot\frac{F_2}{F_1}} \quad (13)$$

$K_1 = 20.75$ W/m²·℃ $K_2 = 103.6$ W/m²·℃

4.4.4

$$\Delta t_m = \frac{\Delta t_1 - \Delta t_2}{\ln\frac{\Delta t_1}{\Delta t_2}} \quad (14)$$

Δt_1 15 ℃ Δt_2 7 ℃ $\Delta t_m =$ 10.5 ℃

4.4.5

$$F = \frac{P}{K\Delta t_m} \quad (15)$$

312 m²

62.5 m² 2

30% ~50%

2

5

[1] . M . . 2004

[2] .300 MVar J . 2018 32 3 70 -72

[3] . M . 1984

[4] . J . 1972 4 27 -33

12

[5] Kocha SS. Handbook of Fuel Cell Fundamentals Technology and Application M . Vielstich W Lamm A Gasteiger H A. Editors Vol. 3 John Wiley & Sons New York 2003

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[7] Banan R Zu J Bazylak A. Humidity and Temperature Cycling Effects on Cracks and Delaminations in PEMFCs J . Fuel Cells 2015 15 2 327 -336

EL-CID

618000

EL-CID 4%

EL-CID

EL-CID EL-CID

EL-CID

TM31 001-9006 2021 01-0017-05

Application Research of Electromagnetic Core Imperfection Detection Test

CHEN Zhan, YU Hongbin, LIU Hang, LIU Xiao

(Dongfang Electric Machinery Co. , Ltd. , 618000, Deyang, Sichuan, China)

Abstract: To inspect the stator core assembly of generator, it is imperative to conduct test for core in manufacture and power plant. At present, for stator core, we preferentially adopt routine test at home, but such routine core loss test requires equipments with large capacity and complex test circuit, which is less economical and inefficent. By contrast, EL-CID core test merely applies 4% of rated flux to diagnose the tested object, what′s more, it equips with the power source with comparatii

2020 – 07 – 29

1987 – 2009

1.4 T

1.0 T

2 EL-CID

2.1

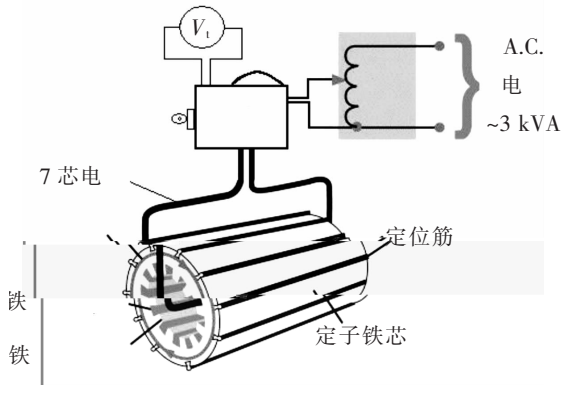
EL-CID

1

4%　　Chattock

4%

Chattock



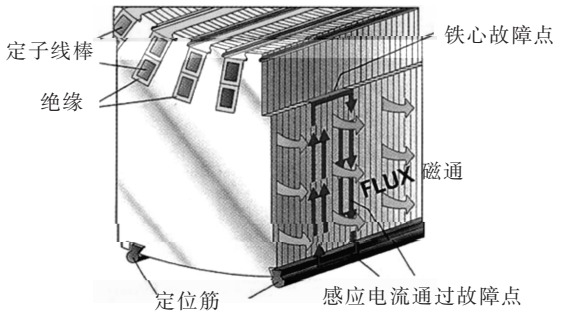
1　EL-CID

2

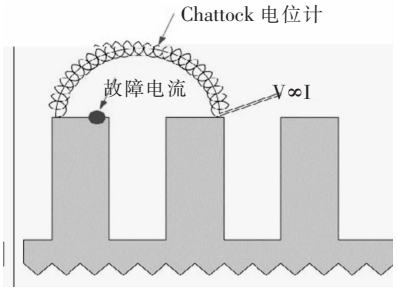
Chattock

90°　　QUAD

3



2　　شمخ　　مجه



3　　يحي　　سخ　　شمخ Chattock مجه

2.2　　ﻧﻮُ

GB/T20835-2016

C　　EL-CID

100 mA

Phase

4%　　100 mA

5 K ~ 10 K

3

EL-CID　　GB/T20835-2016

1

3.1

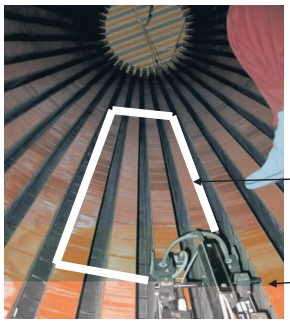
1

EL-CID

4

ﺷﺠ 1 ﺋﻮ

	3.1.1
	3.1.2
	3.1.3
	3.1.4 “L ”
	3.1.5 “U ”
	3.1.6 “U ”
	3.2.1
	3.2.2
	3.2.3
	3.3 EL-CID



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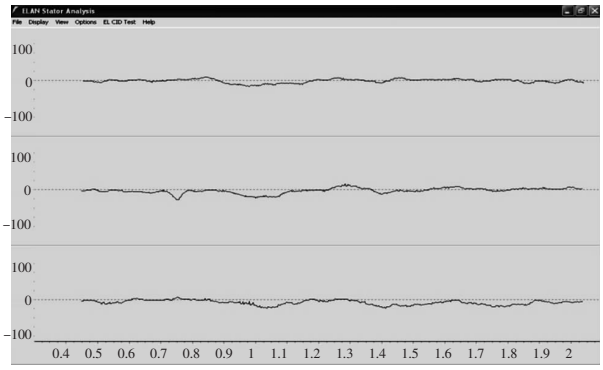

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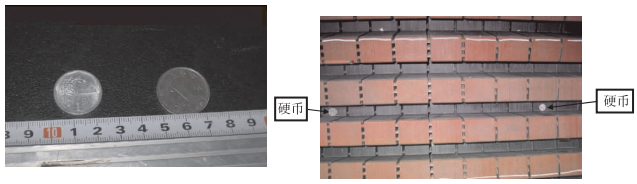
100 mA

2

6 EL-CID

EL-CID



6 ﻟ

3

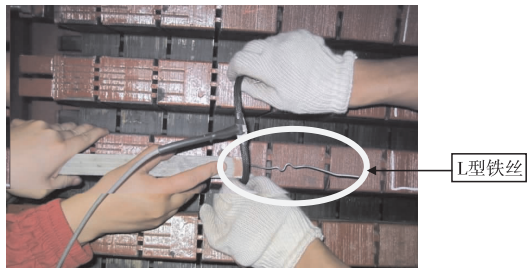
7

16 cm *D*2

7 EL-CID

4 “L ”

8



8 ﻠﻠ

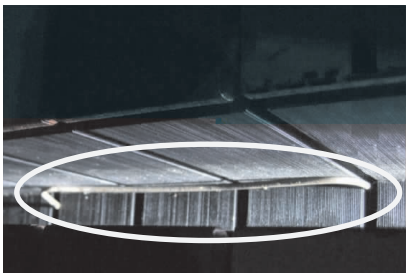
EL-CID

5 “U ” 9

9 ﻠﻠ

EL-CID

6 “U ” 10



U型铁

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2

EL-CID EL-CID

4.2 4%

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2

100 mA

1 GB/T20835 – 2016 S .
2016

660 MW

2021 2 5 660 MW —— 2

75% 50% 8.9 9.3 17.4 4.02

“ ”

660 MW

2 1 000 MW

“ —— —— —— ”

来源:东方电气网

1 2 1

1. 611731 2. 618000

TK474.8 B 1001-9006 2021 01-0022-04

Development Course and Experience of DEC Heavy Duty Gas Turbine

LI Jianhua[1], *HU Weiwei*[2], *XU Bo*[1]

(1. Dongfang Electric Co., Ltd., 611731, Chengdu, China; 2. Dongfang Turbine Co., Ltd., 618000, Deyang, Sichuan, China)

Abstract: This paper reviews the process from the technology introduction of gas turbine industry, the formation of manufacturing localization capacity, and the integration of innovation from the beginning to the final success, focusing on the practice and features of Dongfang Electric's independent innovation, so as to provide a reference for the innovation work of the industry and enterprises.

Key words: gas turbine; natural gas power generation; technology introduction; integration and innovation

1

2002

GE SIEMENS

MHI

2002

2020 – 10 – 12

1972 – 1994

1972 – 1992

1982 – 2008

1

1.	1	1
		2
	2	
	3	
	4	
	5	
	6	
	7	
	8	
2.	1	1
	/	2
	2	
3.	1	1
	2	2
4.	1	
	2	
	3	
5.		
6.		

1 2002 ~ 2008

2001 10

2001 2194 “ ”

24 56

GE

Siemens

Ansaldo

2000 2008

86 000

/

4 067 525

1 500

FAI

3S

2008

——

1

2

3

4

5

2002

2 ~ 2008 2014

2.1

2007

Gas Turbine World 2005

MHI M701F4

M701F4 2 ISO

M701F4 2008

57% 59%

M701F4

M701F4

GE

F

2 M701F4

		/kW	/%	kJ/kW·h
GE	9FA	390 800	56.7	6 350
Siemens	SGT5-4000F	407 000	57.7	6 239
MHI	M701F4	450 000	59.0	6 120

2.2

2008

2009

2014

TBC

3

3.1

GE

2014

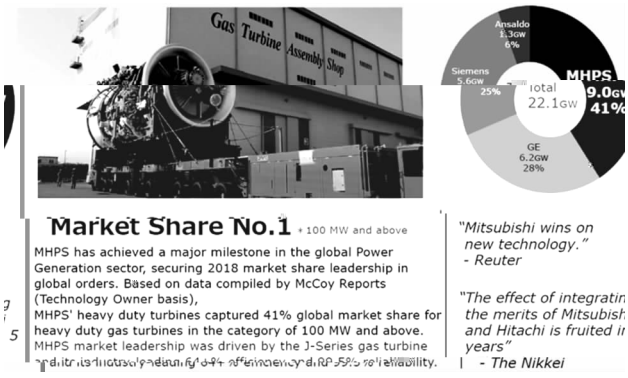
F J

40%

2018 GE

100 MW

1



1 2018 MHPS 100 MW

3. 2 F 50 MW

1 2 2 2 1 2

611731 2. 611731 1.

3

2 2%

TK172 001-9006 2021 01-0026-04

The Comparative Study of Natural Frequency Experiment and Calculation Analysis for Tube Bundle of Heat Exchanger

WANG Bo[1], *MO Kun*[2], *LIU Biao*[2], *WANG Liwen*[2], *CAO Xuefan*[1], *FENG Lin*[2]

(1. Dongfang Electric Co., Ltd., 611731, Chengdu, China; 2. DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China)

Abstract: The vibration analysis is very important for the safety evaluation of heat exchanger. The key in vibration analysis is the acquisition of system modal characteristics. In order to effectively evaluate the safety and reliability of the once-through heat exchanger, a series of modal tests of heat exchange tubes are carried out on feature unit. On this basis, the modal simulation and theoretical calculation of heat exchange tube are carried out. The analysis show that the natural frequency results obtained by the three methods are in good agreement with each other, and the relative error of the natural frequency between experimental results and the simulation results (the first 2 orders) is within 2%. The validity of the analysis results

2020 – 07 – 19

1986 – 2013

3

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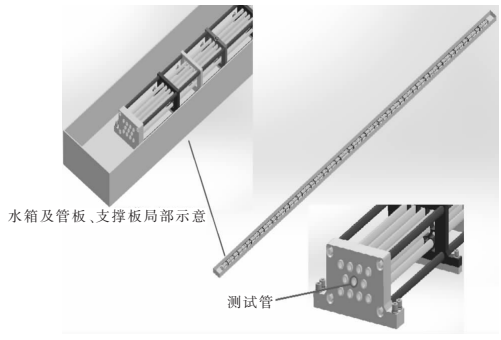
1 11

21 3

4

4

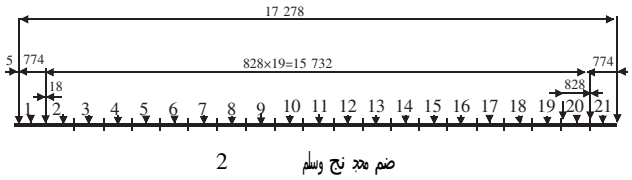
21



1

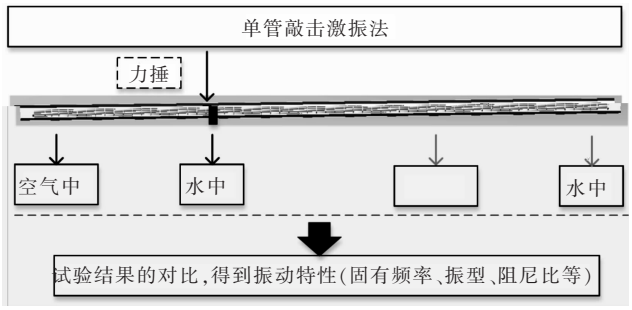
1.2 ضم مجد نج

21 2



2 ضم مجد نج وسلم

1.3



3

7

5

2

2.1

1

5

5 0.2

1 ئو

	شهم		شمخ	
	/Hz	/%	/Hz	/%
1	54.317	1.196	55.687	3.999
2	55.111	2.697	56.673	4.490
3	57.815	1.847	59.190	4.454
4	60.136	2.297	61.724	4.649
5	62.603	1.452	64.485	4.143
6	66.858	1.956	71.583	6.261
7	70.447	2.625	73.763	6.510
8	75.838	2.001	79.545	5.430
9	80.454	1.611	82.693	4.775
10	84.816	2.270	87.373	3.416

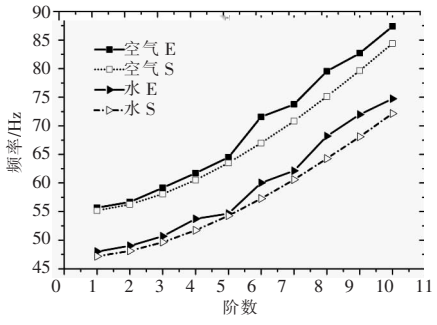
1

54.317 Hz 1 E S
55.687 Hz

2.2

2

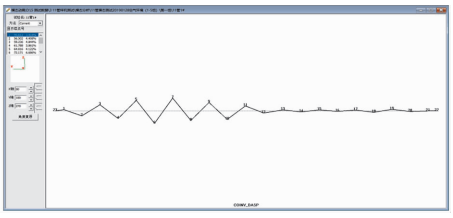
1 47.227 Hz
1 48.013 Hz



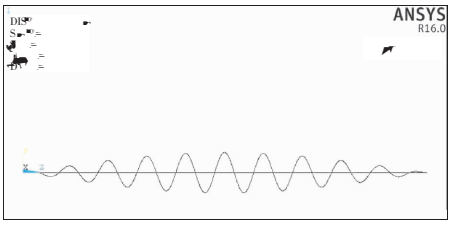
5 и ي
6 7

ئو 2 شھ
ئو ي

	/Hz	/%	/Hz	/%
1	47.227	1.802	48.013	5.459
2	48.706	3.597	49.027	6.138
3	49.844	2.453	50.695	5.670
4	52.492	2.489	53.754	7.008
5	54.072	2.197	54.665	5.518
6	57.947	2.917	60.028	6.698
7	61.397	3.751	62.149	5.172
8	65.492	3.492	68.214	6.952
9	69.278	3.019	71.980	6.217
10	74.319	2.886	74.788	6.453



a

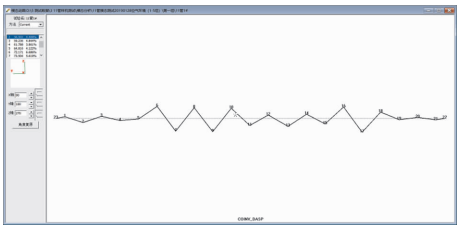


b

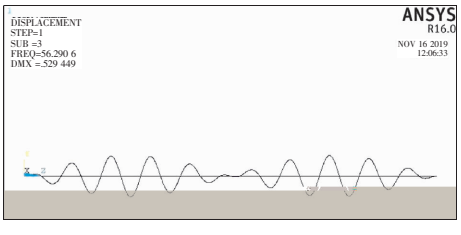
6 ي ـّ لحم ,

3 и

3.1



a



b

4

4

5 7 ي ـّ لحم ,

4

1

54.317 Hz

47.227 Hz

3.2

GBT151 2014

C 2

1

$$f_n = 35.3\,\lambda_n \sqrt{\frac{E(d_0^4 - d_i^4)}{ml^4}} \quad (1)$$

f_n Hz λ_n

rad E MPa d_0

m d_i m m

kg/m l m

3

3

表 3

		1	2		1	2
	Hz	%	%	Hz	%	%
1	55.122	0.91	0.11	47.400	1.77%	-0.47
2	56.236	0.70	0.08	48.357	1.88	-0.48

1 2

3

2

1%

2

2%

3

618000,

Accuracy Analysis and Improvement Measures of Gas Turbine Air Temperature Measurement

WU Zhifang

(Dongfang Electric Autocontrol Engineering Co. , Ltd. , 618000, Deyang, Sichuan, China)

Abstract: The power of gas turbine has a great relationship with air temperature. When the control system controls the power of gas turbine, the measurement accuracy of input air temperature signal must be accurate enough to realize the accurate control of gas turbine power. In this paper, combined with a control system example, the accuracy of air temperature signal measurement loop is analyzed, and the improvement method to improve the measurement accuracy is given. By improving the measurement accuracy of the air temperature signal, the power of the gas turbine can be accurately controlled, and the efficiency of the gas turbine can be improved, which will bring higher economic benefits to the gas turbine power plant.

Key words: air temperature; measurement accuracy; improvement

P η *T* *P* η

3 ①

②

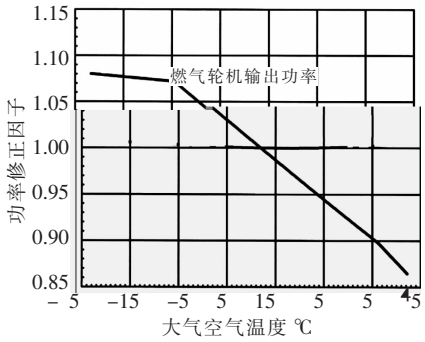
1

1. 1

T

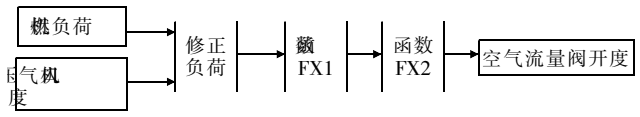
2020 – 08 – 31

1982 – 2004


1.15
1.10
1.05
1.00
0.95
0.90
0.85
燃气轮机输出功率
功率修正因子
– 5
–15
–5
5
15
5
5
45
大气空气温度 ℃

1

2. 2


修正
负荷
函数
FX1
函数
FX2
空气流量阀开度

3

2

TC

0.4

400 ppm/deg C A/D

3 نج وسلم وسلم

RTD

6

AI 4 ~ 20 mA AO 4 ~ 20 mA AI 4 ~ 20 mA

DI DO RTD RTD 2

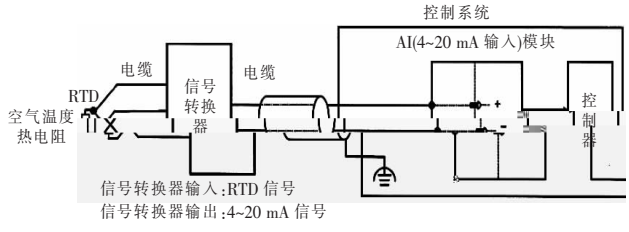
2 ئو AI كا

	RTD	AI 4 ~ 20 mA
1	-40 ~ 60 deg C	4 ~ 20 mA
2	± 0.1% FSD	± 0.1% FSD
3	±400 ppm/deg C	±100 ppm/deg C

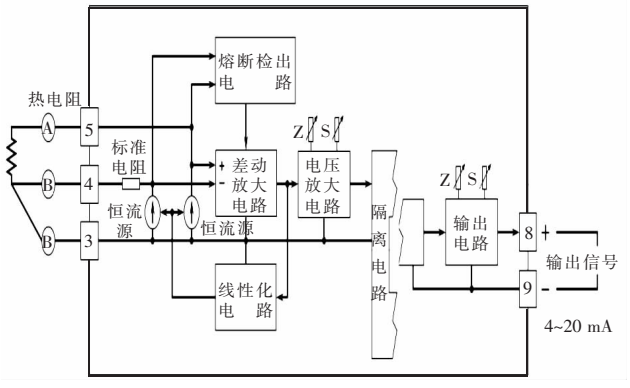
5

RTD 4 ~ 20 mA

AI 4 ~ 20 mA



5 RTD 4 ~ 20 mA أ



6

3 AI 4 ~ 20mA

4 ~ 20 mA

6 3

3 ئو كا

1	-200 ~ 660 deg C	-200 ~ 660 deg C
2	±0.2 %	±0.01 %
3	±0.2 %	±0.04 %
4	±150 ppm/deg C	±100 ppm/deg C

% = 0.2% × 860/100 + 0.2%

% = × 860 /100 + +0.015% ×15 deg = 2.145%

+ × 15 deg C % = 0.01% × 860/100 + 0.04% +

0.01% ×15 deg = 0.276%

0.4

5

+ AI 4 ~ 20 mA

6 AI 4 ~ 20 mA

AI

AI % = 0.1% + 0.01% ×15 deg

= 0.25%

RTD

% =

+ AI 4 ~ 20 mA

$\sqrt{\text{AI}^2 + \quad ^2}$

+ AI 4 ~ 20 mA

% =

$\sqrt{0.25 \times 0.25 + 0.276 \times 0.276}\% = 0.372\%$

deg C = 60 + 40 ×0.372% = 0.372

deg C 0.372

1 . – M .
2002 310 – 312

2021 1 30 5

10

1 828 mm

1 2 3 1 2 3 2 3 2 3 2 3
1. 710049 2. 611731 3. 643001

20 600 ℃
620 ℃
630 ℃

TM621 A 1001-9006 2021 01-0034-06

Innovation and Development of Technologies for Advanced and High-efficient Ultra-supercritical Coal-fired Boiler in China

LIU Yugang[1,2,3], *LIU Yinhe*[1], *MO Chunhong*[2,3], *RAN Shenming*[2,3], *Pan Shaocheng*[2,3], *WANG Ting*[2,3]

(1. State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, 710049, Xi'an, China;
2. Clean Combustion and Flue Gas Purification Key Laboratory of Sichuan Province, 611731, Chengdu, China;
3. Dongfang Boiler Group Co., Ltd., 643001, Zigong, Sichuan, China)

Abstract: China developed the ultra-supercritical boiler technology to improve the efficiency of coal-fired power plant units in 20 years. As the developing of localization of 600 ℃ ultra-supercritical boiler, the development and batch application of 620 ℃ high efficiency once-reheat and double-reheat boilers are carried out in China, and the technologies of wall temperature deviation fine control and double-reheat steam temperature regulation are successfully conquered, which creates foundation for the development of ultra-supercritical boiler with higher steam parameters, and helps to improve the technical level of ultra-supercritical boiler manufacturing in China.

Key words: ultra-supercritical boiler; wall temperature deviation; steam parameters

500 ~
125 MW 1 000 MW 600℃
31 MPa/621 ℃/566 ℃/538 ℃ [1-2] [3] 700 ℃

[4-6]

1992

600 MW 24.2

2020-10-30
2018YFB0604403
1983- 2010

MPa/538 ℃/566 ℃

2

2000

2004

620℃

2019 660 MW 40

120 1 000 MW 20 70

2

620℃

3 ①

②

③

50 ~ 100%

BMCR

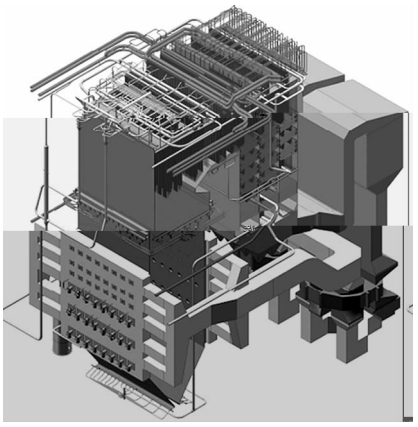
①

②

23 – 24

4

3



2

620 ℃ 600 ℃

3

OPCC

P92

150 mm

620 ℃ 600 ℃

1 Π

OPCC

30 ℃ ~50 ℃ [7]

2

3

[23]

T92 623 ℃

649 ℃ 26 ℃

1#

10 ℃

15 ℃

1#

623 ℃

94.64% NO_x 170 mg/Nm^3

ئۇ 3 جي 620 ℃ كا ي

	/		
			620 ℃
	/MPa	32.5	29.4
	/℃	605	605
	/℃	623	623
	/℃	623	/
	/℃	~330	300 ~315

1# 620 ℃

620 ℃ 3

660 MW 3#

2018 4

ئۇ 4 جي

	2 ×660 MW	32.45 MPa/605 ℃/623 ℃/623 ℃	Π	+
	2 ×660 MW	32.45 MPa/60 5℃/623 ℃/623 ℃	Π	
	2 ×660 MW	34.65 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×660 MW	32.68 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×1 000 MW	33.3 MPa/605 ℃/613 ℃/613 ℃	Π	+
	2 ×1 000 MW	33.2 MPa/605 ℃/623 ℃/623 ℃	Π	+
	2 ×1 000 MW	33.5 MPa/605 ℃/623 ℃/623 ℃	Π	
	2 ×1 000 MW	36.75 MPa/620 ℃/633℃/633℃	Π	
	2 ×1 000 MW	32.45 MPa/605 ℃/623℃/623℃		+
	2 ×1 000 MW	33.2 MPa/605 ℃/623 ℃/623 ℃	Π	+
	2 ×1 000 MW	33.5 MPa/605 ℃/623 ℃/623℃	Π	+
	2 ×1 000 MW	33.5 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×1 000 MW	33.3 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×1 000 MW	32.45 MPa/60 5℃/623 ℃/623 ℃	Π	+
	2 ×1 000 MW	34.21 MPa/605 ℃/613 ℃/613 ℃		+
	2 ×1 000 MW	33.1 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×1 000 MW	33.6 MPa/605 ℃/623 ℃/623 ℃		+
	2 ×1 000 MW	32.45 MPa/605 ℃/623 ℃/623 ℃		+
	1 ×1 350 MW	32.58 MPa/612 ℃/631 ℃/625 ℃		+

3 كا

SA-213S30432

SA-213TP310HCbN 700 ℃

SA-335P92

600 ℃ ~620 ℃

620 ℃ 25 -26

700 ℃

630 ℃

[23 27]

700℃ 630 ℃ 700 ℃

620 ℃ 5

“3

”

620 ℃

ئۆ 5 كا جي كا ي

/		700 ℃	630 ℃	620 ℃
/MPa		36.75	36.75	32.5
/℃		705	620	605
	/℃	723	633	623
	/℃	723	633	623
/℃		~330	~330	~330

3.1 630 ℃

630℃

S31035

G115 630 ℃ [23 27]

S31035

G115

G115

S31035

T91 G115

G115 G115

3.2 700 ℃

700 ℃

–

Alloy617B IN740H Haynes282

GH984G [28 – 37] GH984G

GH2984 700 ℃ [37]

– [37]

SMC IN740H

IN740H

700 ℃

700 ℃

[38] M

[39] U [40]

4

600 ℃

620 ℃

630 ℃

700 ℃

كا B

1 . J .

2013 32 29 1 – 8
2 . 1 000 MW
J . 2009 1 10 – 14
3 . J .
2008 30 2 1 – 4
4 . 700 ℃ J .
2012 17 6 13 – 17
5 . 700 ℃ J .
2013 34 8 69 – 75
6 Siefert J A Tanzosh J M Ramirez J E. Advances in Materials Technology for Fossil Power Plants C //Proceedings from the 6th International Conference 2010. Ohio ASM International 2011 1045
7 . 1 000 MW
J . 2015 29 4 26 – 30
8 . J .
2011 27 1 1 – 5
9 .
J . 2003 23 3 2363 – 2369
10 . J .
2000 31 1 2 – 11
11 .
J . 2013 64 9 3213 – 3219
12 .
J . 2008 28 3 334 – 338
13 .
R . 2005
14 .
R .
2003
15 .
R .
2002
16 .
J . 2012 45 4 101 – 107
17 . J . 2011
27 5 417 – 422
18 . Π
J . 2001 32 2 1 – 6
19 . J .
2002 2 10 – 13
20 Robert Swanekamp. Return of the Supercritical Boiler J . Power 2002 146 4 32 – 40
21 . M .
1989
22 . M .
2007
23 .
J . 2018 51 9 73 – 77
24 . J .
2017 46 8 1 – 15
25 . 700 ℃
J . 2011 31 12 960 – 968
26 . 700 ℃ Alloy 617 mod
J . 2014 34 14 2314 – 2318
27 . 650 ℃
Z . 2016 – 5 – 24
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J . 2019 55 7 893 – 901
38 . J .
2016 35 4 1 – 3
39 .
CN201110090155. 5
P . 2011 – 08 – 10
40 .
CN201120273092. 2 P . 2011 – 07 – 29

1 2 1 3 3 1

1. 618000 2. 611731 3. 300270

TM621 001-9006 2021 01-0040-05

The Operation Strategy of Supercritical Reheating Double Extracting Back-pressure Turbine

LUO Fang[1], *SONG Fengqiang*[2], *HOU Mingjun*[1], *HU Yizhang*[3], *WANG Yong*[3], *GONG Chuanyao*[1]

(1. Dongfang Turbine Co., Ltd., 618000, Deyang, Sichuan, China; 2. Dongfang Electric Co., Ltd., 611731, Chengdu, China;
3. Huadian International Power Co., Ltd., Tianjin Development Branch, 300270, Tianjin, China)

Abstract: It is one of the important directions to promote energy saving and emission reduction promoting the heating technology of back-pressure turbine continuously. Transferring the measures increasing efficiency, such as reheating, heat regenerative system optimization, graded regulation of heating, from large thermal turbine to back-pressure turbine can improve the energy efficiency furtherly. Furthermore, the energy saving measures above-mentioned increase the complexity of the system, but also increase the difficulty of unit operation. This paper takes the supercritical reheating double extracting back-pressure steam turbine for some project as an example to analyze its operation strategy for reference of similar units.

Key words: back pressure turbine; operation; startup

1

3

4.5 MPa 1.4 MPa

350 MW CFB

2 × 50% BMCR 4.5 MPa 5.0 MPa 1 400

1 50% BMCR t/h 1.4 MPa 1.8 MPa

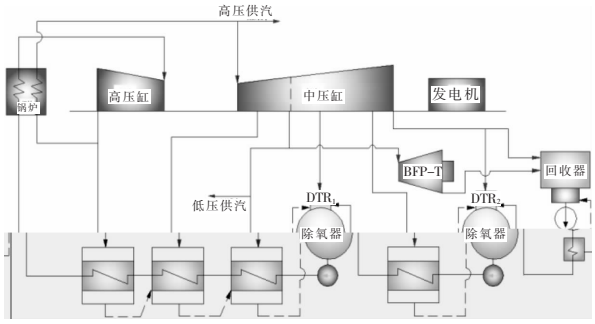
2020 – 06 – 15

CHDKJ19-01-88

1982 – 2003

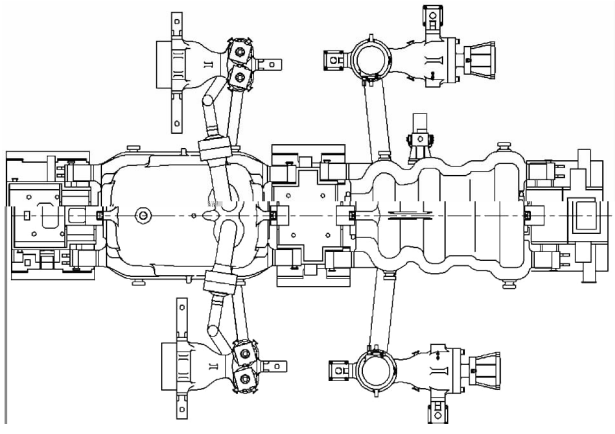
600 t/h 4.5 MPa 980 t/h 1.4 MPa 420 t/h 4.5 MPa 484.4 t/h 1.4 MPa 209 t/h 3 390 t/h 4.5 MPa 1.4 MPa

87% BMCR 96% BMCR



1 ﻓﻲ ل ﻋﻢ

6 1.8 MPa 2



2 ﻓﻲ ل ﻋﻢ

أ ل ﻋﻢ ﻓﻲ 1

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	CCB157-24.2/5.0/1.8/0.15/566/453
	157 MW
	24.2 MPa/566 ℃/453 ℃
VWO	1 172 t/h
	5.0 MPa 1.8 MPa
	467 t/h 200 t/h
	0.15 MPa

3 1 1 1

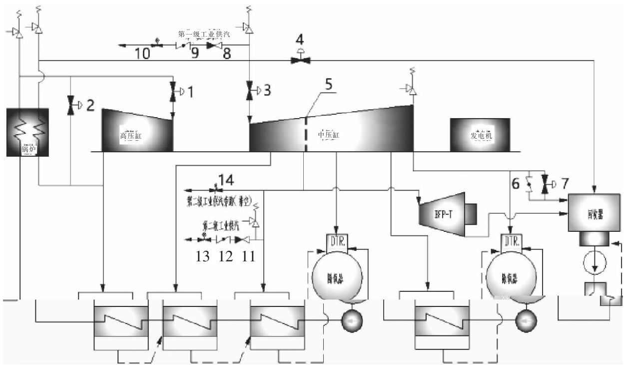
6 7

1 0.15 MPa

1.2

350 MW

3



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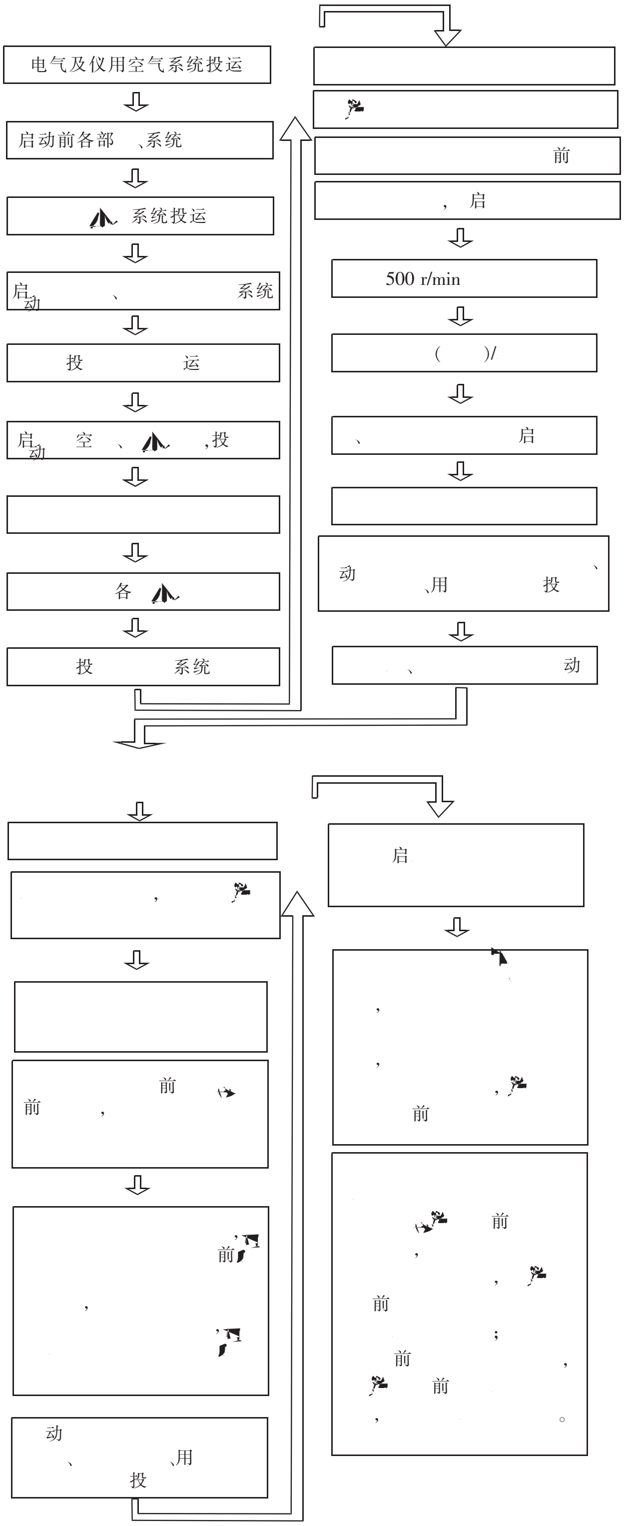
电气及仪用空气系统投运
启动前各部 、系统
系统投运
启 系统
投 运
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4

~40%

425 ℃

2

150 g/kWh

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1 . M . 1988 3
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618000

15° 5 600 mm

37.1% 39%

TM621 001-9006 2021 01-0045-04

Effect of Guide Structre on Aerodynamic Performance of Exhaust Hood in Steam Turbine

PENG Guowei, HUANG Yuandong

(Dongfang Turbine Co. , Ltd. , 618000, Deyang, Sichuan, China)

Abstract: Based on the background of a modified steam turbine, By using numerical simulation and theoretical calculation methods to study the exhaust steam passage of the low pressure cylinder, this paper analyzes the influence of the initial diffusion angle and outer diameter of the guide ring in the exhaust steam passage of the low pressure cylinder . The results show that as the initial diffusion angle of the diversion ring decreases and the outer diameter of the diversion ring increases, the static pressure recovery coefficient of the exhaust cylinder will increase. When the initial diffusion angle is 15°, the outer diameter of the diversion ring The diameter is 5600mm, the streamline fits better with the diversion ring, the flow field distribution is stable, and the static pressure recovery coefficient is the largest; the optimization of the diversion ring structure can increase the static pressure recovery coefficient of low pressure exhaust steam by 37.1%, and the total pressure loss coefficient Reduced by 39%, the exhaust steam performance is better.

Key words: exhaust cylinder; guide ring; turbine; Finite Element

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600MW

0.1

0.1% ~0.15% [3]

2020 – 08 – 27

1986 – 2012

1

1.1

1

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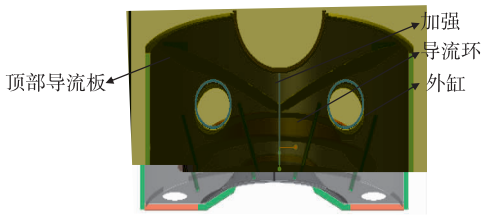
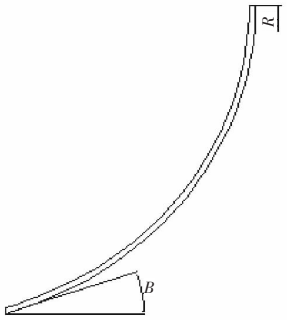




3 سمم

2. 1 شمخ

2 15°

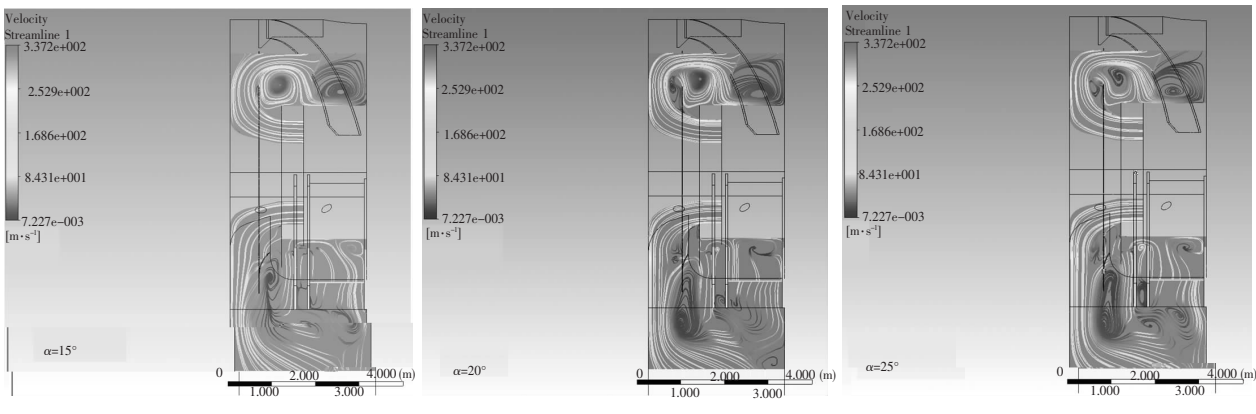
20° 25° *D*5600

4 5

45°

$R = 2\ 800$ mm

α 15° 3 20° 2 25°



5

2 ئو ئو ي

		1	2	3
α/°	26	25	20	15
R/mm	2 600	2 800	2 800	2 800
P_{in}/Pa	13 083.3	12 893.7	12 523.8	12 147.7
P_{out}/Pa	13 026.7	13 028.2	13 024.2	13 022.4
Po_{in}/Pa	15 099.4	14 949.4	14 647.1	14 342.5
Po_{out}/Pa	13 307.7	13 228.8	13 275.7	13 248.2
	0.028	0.065	0.236	0.399
	0.888 7	0.837	0.645 9	0.498 6

2. 2 سمم شمخ

3

*R*2800 *R*2384 *R*2200

6

45° 45°

15° $R=2\ 800$ 3

mm 3 2 384 mm 2 2 200 mm $R=2\ 800$ mm 3

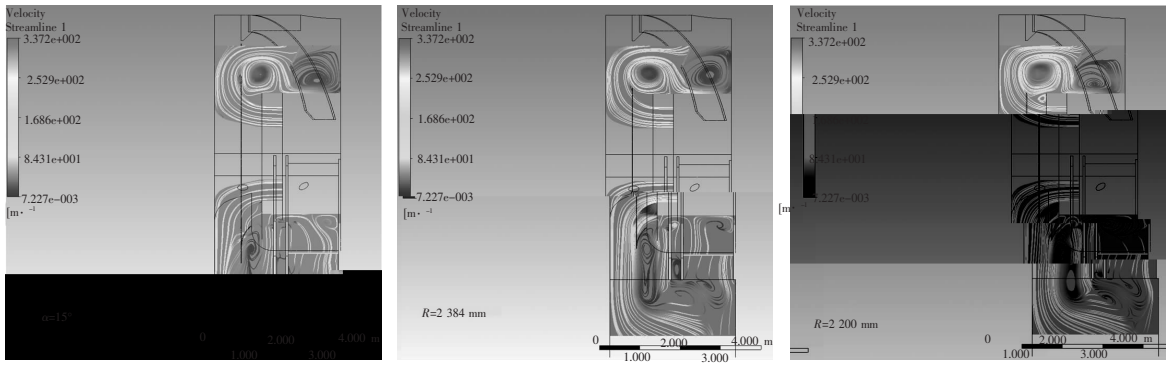
1 $R=2\ 800$ mm

3 A

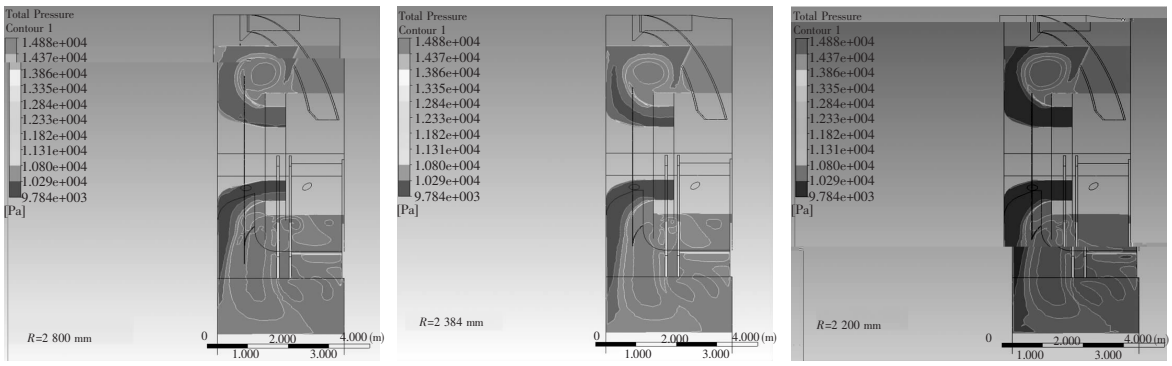
2 1 A

$R=$

7 2 800 mm



6



7 ضم

ئۇ 3 ئۇ ي

		3	2	1
α/°	26	15	15	15
R/mm	2 600	2 800	2 384	2 200
P_{in}/Pa	13 083.3	12 147.7	12 305.5	12 616.2
P_{out}/Pa	13 026.7	13 022.4	13 025.2	13 025.1
Po_{in}/Pa	15 099.4	14 342.5	14 460.4	14 7

7

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UG

UG

TG659 001-9006 2021 01-0049-06

Research on Multi-axis N/C Machining Technology of Open-integrated Impeller

WU Zhongjing, DUAN Changde, QIAO Jie, WU Wei

(Dongfang Electric Machinery Co. , Ltd, 618000 , Deyang, Sichuan, China)

Abstract: In this paper, for the NC programming of the open-integrated impeller, through the study of machining process, the processing procedure and the machining center, the tool selection strategy is determined. An efficient and optimal way of multi-axis NC programming is adopted based on the software of UG, and an experimental open-integrated impeller of high quality is produced, which proves the feasibility of the study.

Key words: integrated impeller; UG; multi-axis machining; NC programming

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“3 + 2 ”

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2020 – 12 – 25

1989 – 2011

1979 – 2002

1982 – 2011

1966 –

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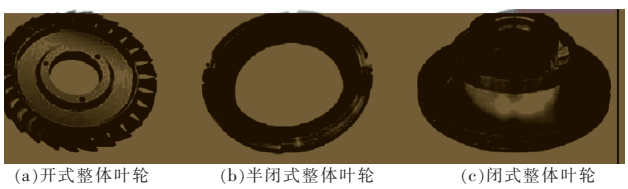


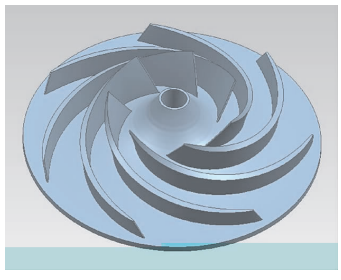
(a)开式整体叶轮　(b)半闭式整体叶轮　(c)闭式整体叶轮

1　　شنخ

1.1

2　　7

1



2　　و

ةو 1　　كا

mm

	582	50	/
	113	38	/
	13.2	3.5	10.7
	3	3	3
	6	6	6
	79	33	52.8

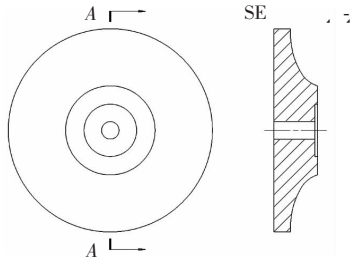
1

1

1.2

Ra 3.2μm　　±0.2 mm

3



3　　لى

6

①　　②　　③

④　　⑤

⑥

1.3 تم

582 mm CW6163C

DMG DMU 125P

4 XYZ

A C

4 DMU125P

1.4 سجِ

*D*20*R*10

*D*16*R*8

6 mm *D*12*R*6

2

ئو 2 سجِ كا

mm

*D*52*R*5	155
*D*25*R*5	220
*D*20*R*10	160
*D*16*R*8	160
*D*12*R*6	168

2.2 UG شمخ بخ ى

UG PRO-E Cimatron MasterCAM

Open Mind Hyper mill Concepts NREC MAX-PAC

UG NX7.5

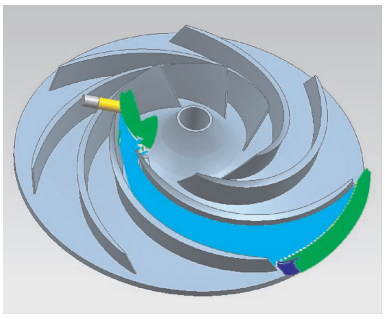
Unigraphics UG CAD/CAM/CAE / /

4

UG NX7.5

2.1 شح

5 *D*20*R*10 UG blade_finish



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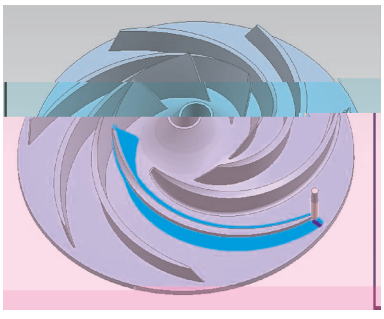
7



7

cavity_mill

*D*52*R*5

*D*25*R*5

3 +2

6

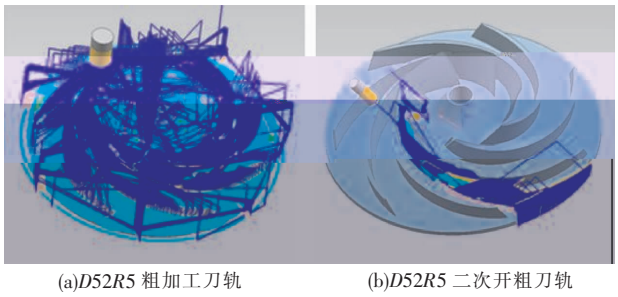
IPW in process workpiece

IPW IPW

variable_contour

U *V*

6 – 7



(a)*D*52*R*5 粗加工刀轨 (b)*D*52*R*5 二次开粗刀轨

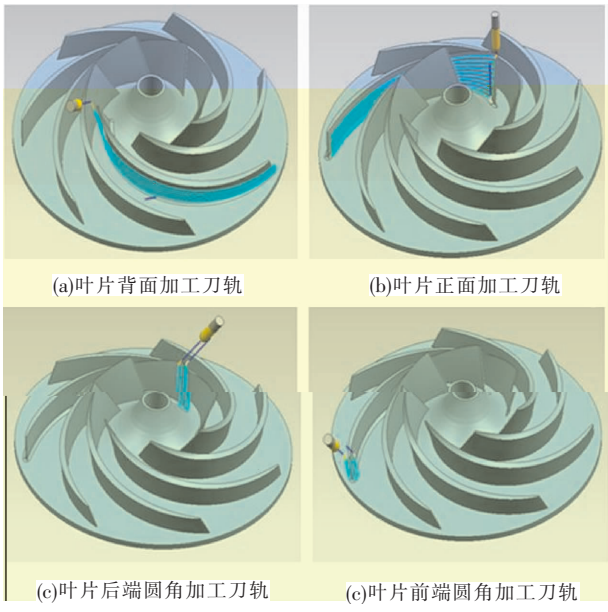
6

“3 +2 ”

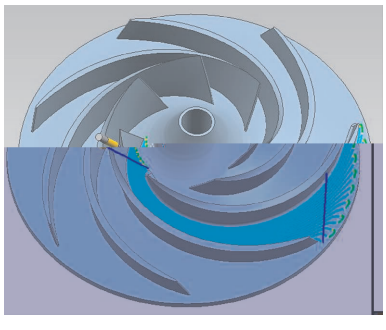
8

2. 2

9



8 شد سح



9 شد سح

“3 + 2 ”

2. 3

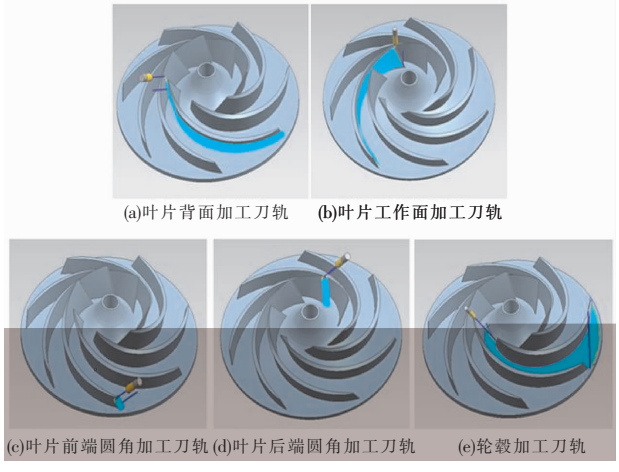
*D*16*R*8

10

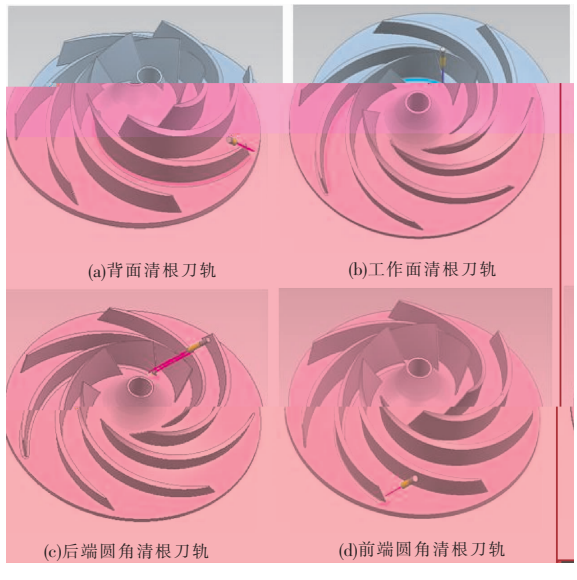
2. 4

6 mm *D*12*R*6

11



10 سح



11 سح

3 ①

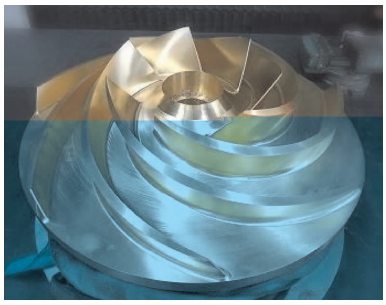
“3 + 2 ”

②

③

3

12



12

Ra3.2 μm 3

3

mm

	0.152 1	0.016 3	0.064 8
X	0.174 8	0.013 5	0.036 1
Y	0.152 1	0.010 6	0.030 7
Z	0.136 7	0.002 5	0.044 2

0.064 8 mm ±0.2 mm

48

*R*2800

3 15°

*R*2800

37.1%

39%

4

4

UG

1 . J . 2014 2 31 – 38

2 . D . 2017 3 – 4

3 . M . 2011 8 – 9

4 . M . 2011 6 – 7

5 . UG NX6.0 M . 2010 1

6 . UG J . 2008 1 25 – 26

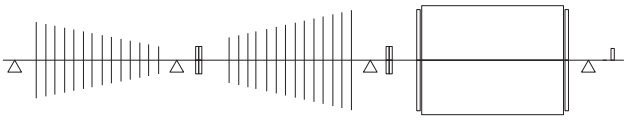
7 . UG J . 2007 8 4 40 – 44

1 . J . 2002 2 1 – 6

2 . J . 2018 2 7 – 12

3 . 600 MW J . 2017 38 2 41 – 43

2020－09－04

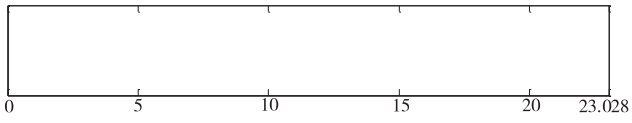


5 5 ~ 8

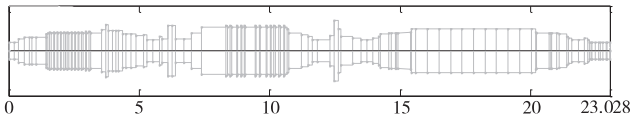
ئو 5

Hz

1	30.2
2	66.8
3	140.4
4	173.1



5 لحم " 30.2 Hz،



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BTM614 BA ى B1001-9006 2021 01-0058-03

Research on Acquiring Experimental Data Acquisition System for Wind Farms

XU Fuxia[1], *LI Yuxia*[1], *CHEN Feng*[2]

(1. Dongfang Electric Wind Power Co., Ltd., 618000, Deyang, Sichuan, China;
2. Dongfang Turbine Co., Ltd., 618000, Deyang, Sichuan, China)

Abstract: Based on the needs of experimental data collection, an automated data collection tool is studied in this paper. Through experiment demand data collation, and relying on the demand on the collection tool, the relevant demand data is automatically obtained through the collection tool, including historical data, without human intervention. The results show that this automatic collection tool makes data collection more convenient, smarter and simpler. The data collection tool fully meets the laboratory's requirements for experimental data, and is configured and selected according to needs, which is important for the efficient acquisition of data.

Key words: experimental data; acquisition tool; automation; intelligence

4.0 ①

②

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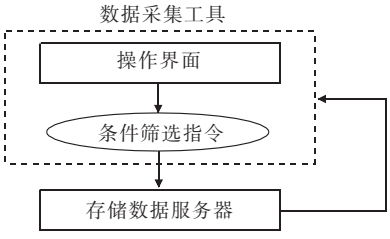
B2020 – 06 – 29

B 1980 – 2006

1 في

2 في

1



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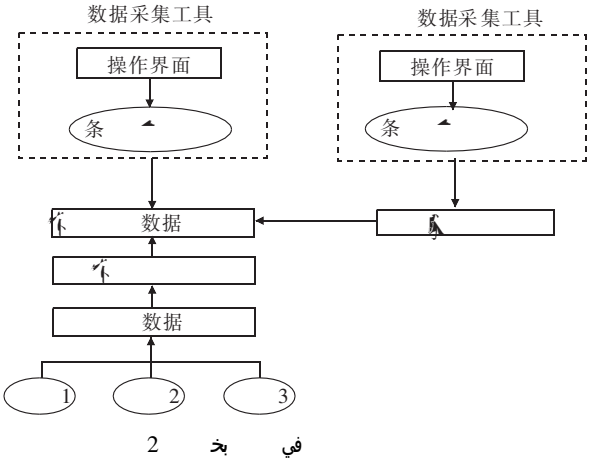


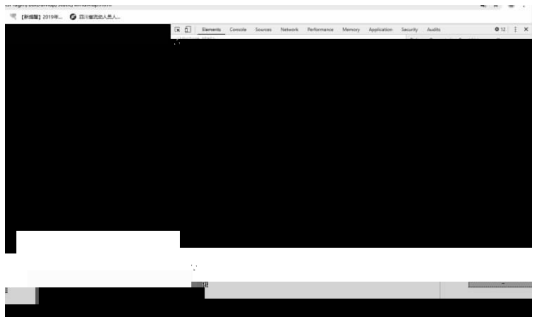
2 بخ في

3 في

Python

HTML5

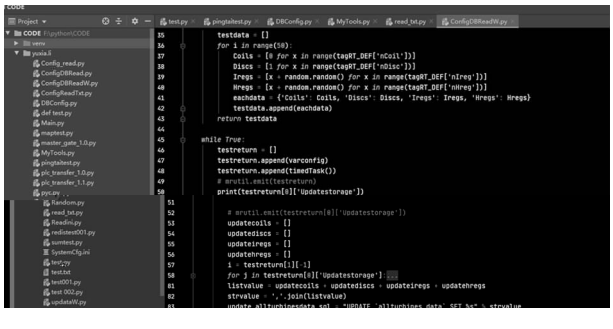
3



3 HTML5 بخ

Python

4



4 Python بخ

4 في

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عم مجم حمي

2021 1 31 23 6 15

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“ ” “ ”

6 300 MW –

650 m

“ ”

21.6

47.5 1.079 2.879

“ ” “ ” “ ”

来源:东方电气网

TRIZ

618000

TRIZ

TRIZ

TM614 A 1001-9006 2021 01-0061-04

Application and Discussion of TRIZ Theory in Improvement of Yaw System of Wind Turbine

SUN Zhongze, SU Ninglie, YANG Xiaolin

(Dongfang Electric Wind Power Co. , Ltd. , 618000, Deyang, Sichuan, China)

Abstract: In the yaw system design of wind turbines, according to the design of driving load, the strength of outer teeth of bearing and driving teeth is often insufficient, especially for motor starting conditions. Therefore, it is often necessary to consider increasing the number of drivers, or increasing the tooth width, which increases the cost. Based on the innovative methodology of TRIZ, brainstorming is carried out to optimize and improve the driving structure in a directional way, and many new schemes are obtained for evaluation and verification by design engineers. In this paper, the yaw system of wind power is taken as the object to discuss the methodology for reference in other fields.

Key words: TRIZ; innovative method; wind turbine; yaw system; tooth surface

TRIZ

2020 – 09 – 15

1987 – 2011

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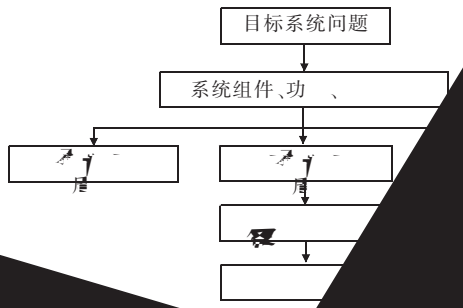
1. 2 بخ

1 RIZ

ABCD



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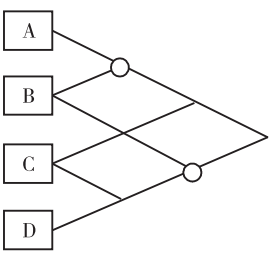

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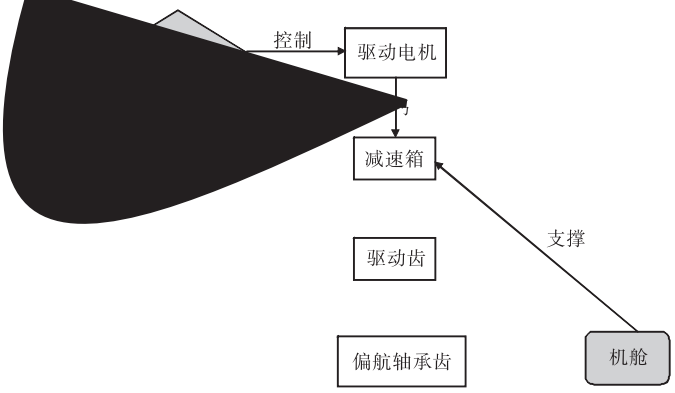

2. 2 أ تى

40 “

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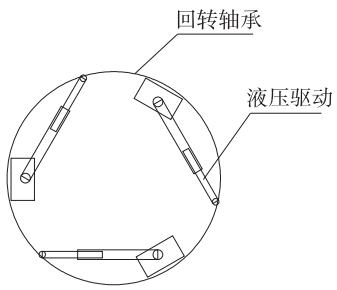

6 لحم

4. 2 تم

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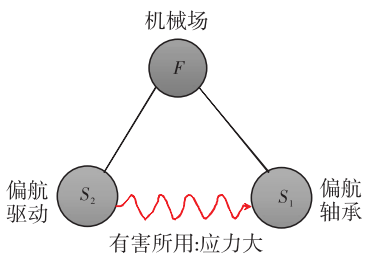

7 لحم شمخ تم

1 No. 15 –

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偏航
驱动

偏航

气动力场

618000

CFD

TM612 A 1001-9006 2021 01-0065-05

Analysis and Research on Guide Vane Water Leakage in Large Francis Hydro-turbine Unit

SONG Min, LI Haoliang, ZHANG Hong

(DongFang Electrical Machinery Co. Ltd. , 618000, Deyang, Sichuan, China)

Abstract: The guide vane water leakage strongly influenced the water energy utilization, effective operation, material damage and other issues of hydro-turbine. Thus, the guide vane water leakage is an important factor for hydro-turbine, which is usually measured in prototype tests but lack of prediction, analysis and optimization methods in design stage. Based on the structural statics and CFD finite element analysis (FEA) method and theoretical computation, this study analyzes the water leakage at guide vane vertical-surface gap with different trailing-edge shapes and the water leakages at flange plate gap. Results show that the optimum guide vane scheme obviously Sid

S Sa e len e a o n

2020 – 12 – 25

1979 – 2002

1986 – 2011

1991 – 2014

1 – 3

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8 – 10

CFD

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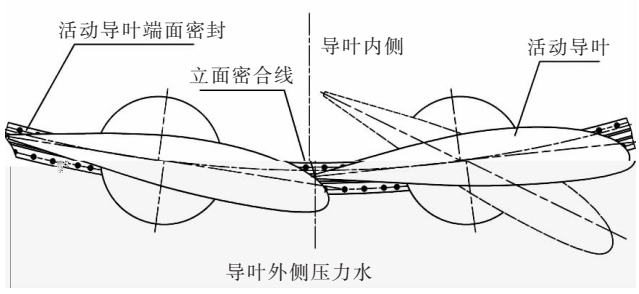

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1. 2 أ ي

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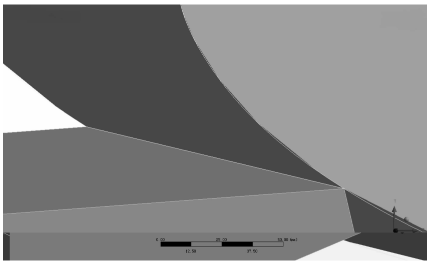

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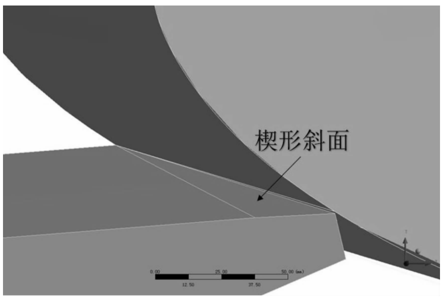

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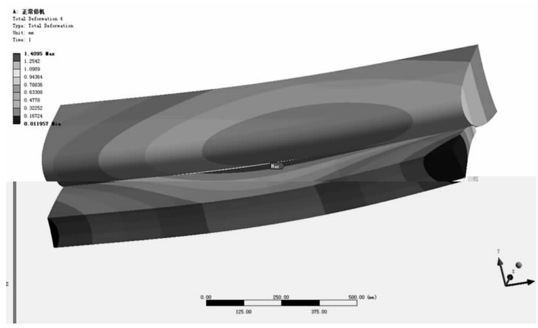

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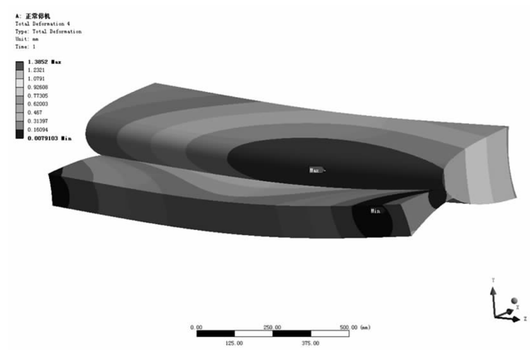

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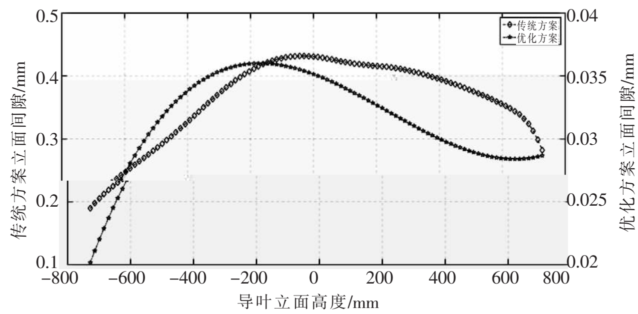


7

Q_Z

[11]

$$Q_Z = \mu\sqrt{2g\cdot\Delta H}A = \mu\sqrt{2g\cdot\Delta H}\sum_{i=1}^{24}A_i \quad (1)$$

μ 0.62[12] A_i i

A g

ΔH

24

24

Q_Z

5 6

58

1

496.31 mm^2 0.465 9 m^3/s

46.13 mm^2 0.043 3 m^3/s 9.3%

ئو 1

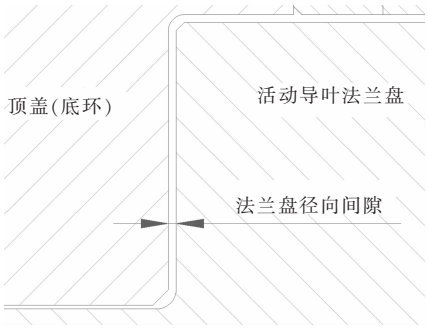
	/mm^2	/m^3·s^{-1}
	11 911.44	0.465 9
	1 107.12	0.043 3

2

8

a mm a

mm $2a$ mm $3a$ mm



8 سمم أحه

2

2

Q_f m^3/s

h_f mm

$$Q_f = b_1 h_f + b_2 \qquad 2$$

b_1 b_2 $b_1 = 0.204\ 3$ $b_2 = 0.051\ 8$

ئو 2 سمم أحه

m^{3}Ks^{-1}

a mm	5.269 3E−03	0.252 9
$2a$ mm	9.727 9E−03	0.466 9
$3a$ mm	1.378 1E−02	0.661 5

9

3 سمم

$2a$ mm

0.465 9 m^3/s 0.466 9

m^3/s 0.93 m^3/s

0.97 m^3/s

4

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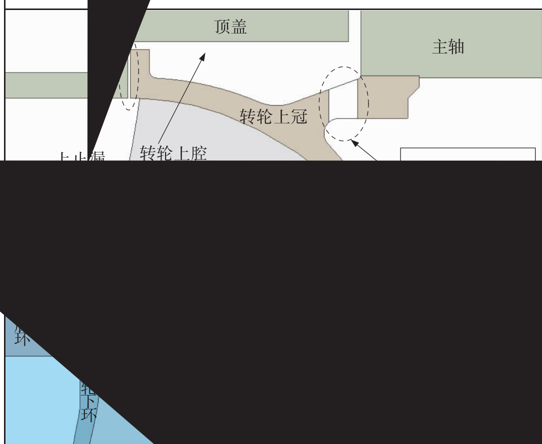
$$P_k = \frac{\mu}{\rho}\left(\frac{\partial \mu}{\partial x_j}+\frac{\partial \mu}{\partial x_i}\right)\frac{\partial \mu}{\partial x_j}$$ [redacted]

1 4 ρ x μ

1

$C_\mu = 0.09$ $C_{1\varepsilon} = 1.44$ $C_{2\varepsilon} = 1.92$ $\sigma_k = 1.0$ $\sigma_\varepsilon = 1.3$

2.2



[redacted]

1/12 1/

16

[redacted]

1

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2.1

214 rpm

10^{-5} 2

1

Dout Ain

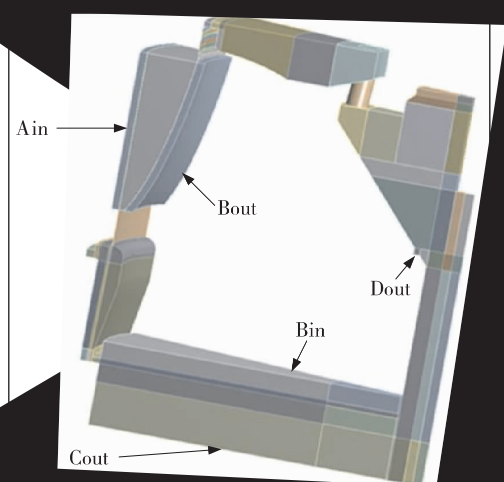
N-S

4/3

5 CFD

ANSYS-CFX

k-ε [6]



2

$$\frac{\partial \rho}{\partial t}+\frac{\partial(\rho u_j)}{\partial x_j}=0 \quad (1)$$

$$\frac{\partial(\rho u_i)}{\partial t}+\frac{\partial(\rho u_j u_i)}{\partial x_j} = -\frac{\partial p'}{\partial x_i}+\frac{\partial}{\partial x_j}\left[\mu_{eff}\left(\frac{\partial u_i}{\partial x_j}+\frac{\partial u_j}{\partial x_i}\right)\right]+\rho g_i \quad (2)$$

k

$$\frac{\partial}{\partial x_j}\left[\rho u_j k-\left(\mu+\frac{\mu}{\sigma_k}\right)\frac{\partial k}{\partial x_j}\right]=\rho P_k-\rho\varepsilon \quad (3)$$

ε

$$\frac{\partial}{\partial x_j}\left[\rho u_j \varepsilon-\left(\mu+\frac{\mu}{\sigma_\varepsilon}\right)\frac{\partial \varepsilon}{\partial x_j}\right]=\rho\frac{\varepsilon}{k}C_{1\varepsilon}P_k-\rho C_{2\varepsilon}\varepsilon \quad (4)$$

$$u_i = \rho C_\mu \frac{k^2}{\varepsilon}$$

表 1

	/			
Ain	/kg·s^{-1}	22 155	20 872	19 110
Bin	P_1/MPa	0.106	0.175	0.365
Bout	P_2/MPa	0.528	0.696	0.712
Cout	V/m·s^{-1}	13.135	12.374	11.330
Dout	P_3/MPa	0.094	0.163	0.352

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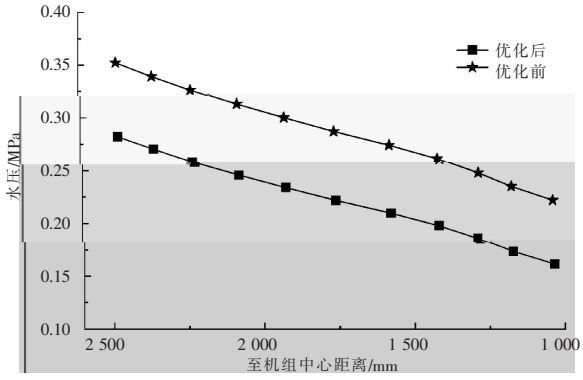
0.365 MPa

0.36 MPa

3 5

16.7%

20.5% 4.2%



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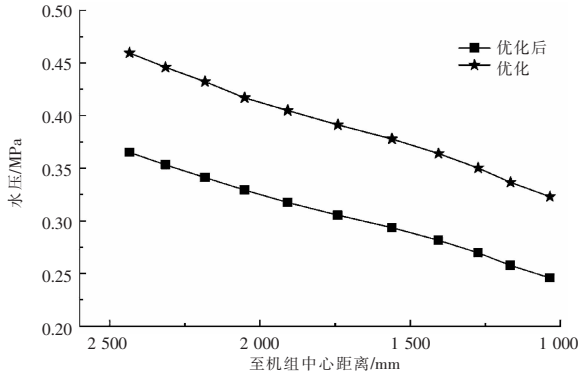

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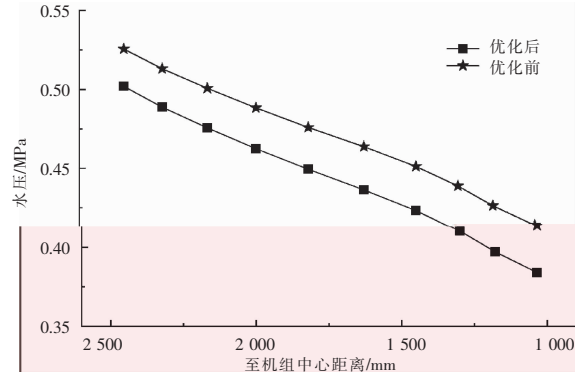


5 ضم

6

23.9%

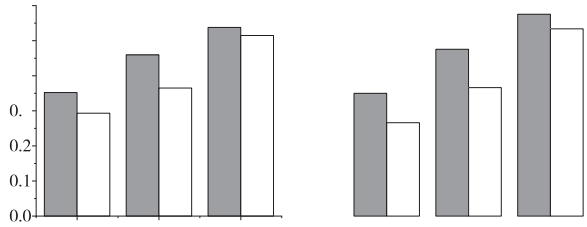
20.5% 7.2%

7

26.5%

44.7%

80%



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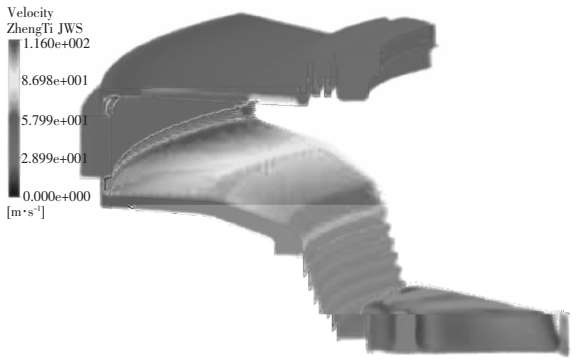

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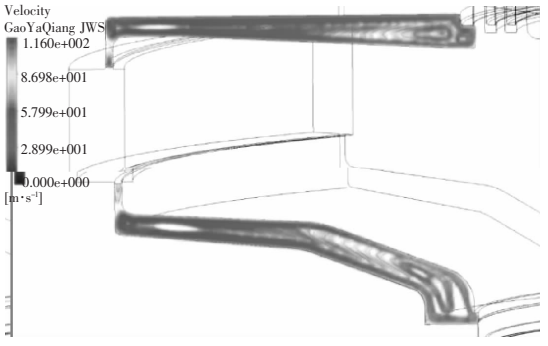

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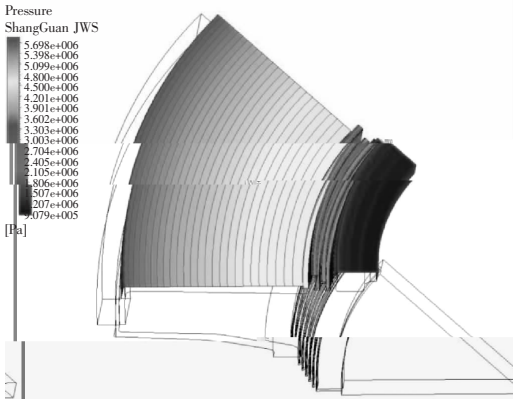

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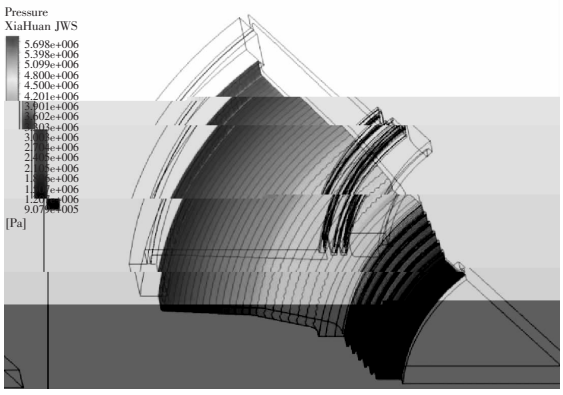
2. 1 أ صمم ظم احد



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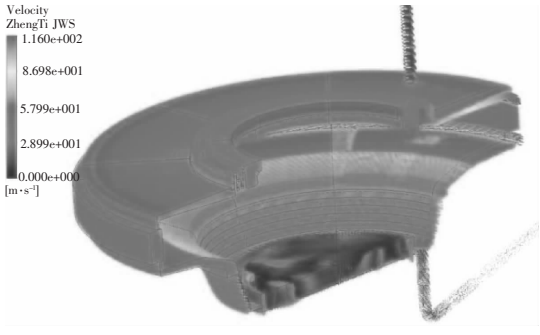

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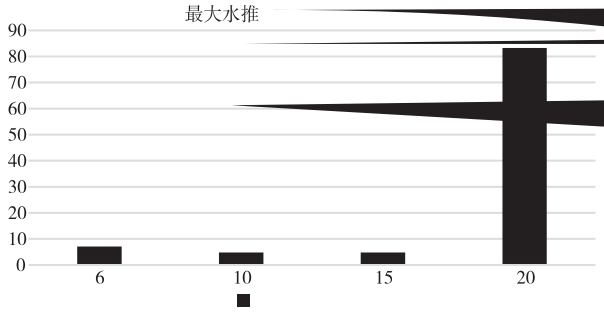
4.8%　　20 mm　35　　83.3%

10



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TP391 001-9006 2021 01-0077-08

Survey of Alarm Correlation Analysis for Communication Networks Based on Machine Learning

DING Hong[1], *ZHOU Honglin*[2]

(1. China Mobile Group Sichuan Co., Ltd., 610000, Chengdu, China; 2. DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China)

Abstract: Alarm correlation analysis is the main technology for fault management in telecommunication networks. By means of alarm correlation analysis, the network maintainer easily reduces the redundant alarms and locates the root alarm. It is also one of the key technologies for AIOps. Therefore, it is significant to summarize the procedure and algorithm for alarm correlation analysis. As a first step, this paper introduces the general procedure for machine learning-based alarm correlation analysis in telecommunication network. In the following, the current research status for several key steps like alarm preprocessing, correlation analysis algorithm, and correlation rule generation are introduced and compared in detail. Then, the implementation of alarm correlation analysis based on big data processing framework has been summarized. Finally, the conclusion is drawn and the future research direction of alarm correlation analysis is also proposed.

Key words: alarm correlation analysis; correlation rule mining; machine learning; data mining; fault management

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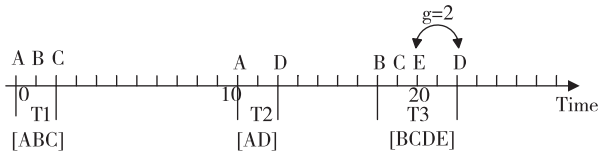

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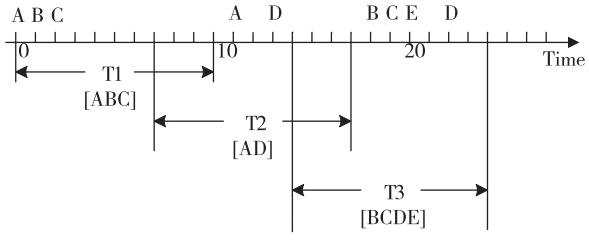

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37 FP-Growth
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Application Research of Honest Risk Prevention and Control In Post Work Flow

JIANG Lina, CHEN Jian, ZHAO Xiaobo, LONG Yuting

(Dongfang Electric Co. , Ltd. , 611731, Chengdu, China)

Abstract: The discipline inspection has not been in a passive situation any more, when honest problems piled up and negative impact revealed. Nowadays, the honest risk prevention and control is more developed, getting on the root and concerning more on the prevention and long-acting. Sorting out the post work flow and rules and regulations process overall, investigating the potential honest risk, grading the honest risk and making prevention and control measures. Then the honest risk for each post and each work flow could be reduced to the low level with power exercised in the institutional cage and locked in the work process chain. The article describe this innovative working methods in detail, analyze, summarize and share the working experience.

Key words: honest risk; post work flow; rules and regulations process; prevention and control measure

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来源:东方电气网