

Bypass control for heat exchanger networks based on frequency domain stability analysis

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Abstract: The operating conditions of heat exchanger networks often change during running processes. In order to fulfill the basic requirements of safe and stable operation, the key points affecting the dynamic performance and stability of the system were obtained based on frequency domain stability analysis, and a design of bypass control system was proposed. The interactions of potential bypasses and controlled variables were analyzed from the perspective of the frequency domain, and the design of bypass for heat exchanger networks was realized by frequency domain relative gain array. The controller parameters of the control system were then designed to make heat exchanger networks meet a certain stability margins. Case studies indicate that under the control of the bypass and PID controller parameters based on the stability analysis method in the frequency domain, the dynamic performance of the system is better and the IAE (integral of absolute error) of heat exchange networks is smaller.





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	WESTPHALEN	[28]			[29]	
		(non square relative gain array	ns-RGA)			
BRACCIA	[30-32]			[33]		[34]
	[35]					

^[36] (relative gain array RGA)

2



Fig.1 Stability of flexible region



$$_{ip}(\omega) = a(\omega) + b(\omega)j$$
 (1,0j)
 $_{ip}() = \sqrt{(a - 1)^2 - b^2}$ (8)

 $\lambda_{ip}(\omega)$ ω

$$D_{ip} \quad \frac{1}{n \quad 0} \quad \int_{0}^{n} \int_{0}^{ip} (\)d \tag{9}$$

(1)		1	1
(2)			III IV
(3)	(1,0j)		

3.2





(a) the distribution of the average relative gain of y_{11}



(b) the distribution of the average relative gain of y_{10}

8 Fig.8 Distribution of the average relative gain in frequency domain



34	1
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	y 5 y 10	y ₁₁	110	162	162 ℃	52 °C	
[41]						11(a) 11(b)	11(c)

11 [41]

]				11
	y ₁₁	168.34 s	0.004 °C	[41]
228.86 s	0.013 ℃ y₅	252.02 s	0.014 ℃	[41]
244.41 s	0.113 ℃ y ₁₀	165.32 s	0.003 °C	[41]
280.26 s	0.067 °C			
[41]	6 11			

5

- (1) (2)
- (3)

2
0

	:									
A	_	m ²		n	_					
Am		dB		Р	_					
D _{ip}	_			PM	—					
f	_			q _c	_					
G	—			q _h	—					
GM	—			R	—					
G (jω)	—			Re	—					
G ^φ (jω) — G (jω)		u	—		c	С		
G _c (jω)) —			У	—		c	С		
h	—			Z	—					
Im	—			(<i>w</i>)	—	RGA				
Kı	—			ω_{c}	—		Hz			
Κ _P				ω_{x}	—		Hz			
L	—			Λ_0	—				RGA	
m	—			$arphi_{m}$	—		0			
	:									
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