## Contents

Fo	rewor	$\mathbf{d}$	ix
Pro	eface		X
1	1.1 1.2 1.3	ic Models Synchronization in nature and technology Automatic synchronization systems Collective systems Lattice models	1 1 2 5
2	150	amics of a Chain of Phase Lock-Loop Systems n Unidirectional Coupling	13
		The equation of a flow chain. Dynamics of a	10
	21.1	"point" element	13
	2.2	Synchronization regime	16
		Development of spatial instabilities. Landau	
		model of developing turbulence	24
	2.4	Transition processes	28
3	Effe	ct of Inertia of Elements on the Dynamics	
		Flow Chain	33
	3.1	Dynamics of a partial system with a filter	33
	3.2	On possible regimes in the chain	36
	3.3	Global synchronization	37
	3.4	Scenarios for the development of chaos	41
	3.5	Characteristics of transition processes	44
	3.6	Pattern formation	49
	3.7	Chains with more complicated dynamics of	
		elements	51
4		ins with Mutual Coupling	63
	4.1	Synchronization in isotropic and anisotropic	
		chains	63
	4.2	Stationary structures. Chaos	70
	4.3	Transition processes	74
	4.4	A chain of coupled inertial systems	80

5	Chains with Coupling Through Phase			
		matching Signals	85	
		Flow chain	85	
	5.2	Mutual coupling	94	
6	Nonlinear Dynamics of Lattices			
	6.1	Synchronization processes in the lattice with		
		unidirectional coupling	107	
	6.2	Isotropic lattices	110	
	6.3	Coherent periodic structures	115	
	6.4	The influence of the external field on the		
		lattice dynamics	120	
7	Ana	lysis of Stationary Synchronization Regimes	127	
	7.1	Stationary regimes in the chain	127	
	7.2	Stationary regimes in the lattice	137	
8	Som	e Remarks on Other Kinds of Chains of		
	Syn	chronization Systems	145	
	8.1	Series chains	145	
	8.2	Wave properties of the chain of frequency		
		lock loops	151	
9	Stab	oility and Chaos in the Chains of Discrete		
	Pha	se-Lock Loops	169	
	9.1	On the dynamics of a partial system	169	
	9.2	Chaotic and regular chain behavior	171	
	9.3	Conditions of existence of a stable		
		stationary regime	175	
	9.4	Conditions of synchronization	182	
10	Dynamics of a Ring Chain of Discrete Systems			
		Possibility of synchronization	187	
	10.2	Regular dynamics and chaos in the ring chain	190	
		Stationary waves and spatially		
		homogeneous regimes	193	
	10.4	Stability of stationary waves	198	
	10.5	Modulated waves	205	

11	1 Order and Chaos in the Discrete Model of an					
	Active Medium	211				
	11.1 Some remarks on the model	212				
	11.2 Chaotic dynamics of the model	212				
	11.3 Spatially homogeneous and stationary states	218				
	11.4 Stationary waves	228				
12	Results and Problems	233				

3%