

Contents

1	Introduction	1
1.1	Traditional Approaches for Electric Load Forecasting	2
1.2	Artificial Intelligent Technology for Electric Load Forecasting	4
1.3	Support Vector Regression for Electric Load Forecasting	5
1.4	Feasible Approaches to Improve the Forecasting Accuracy Performance	7
1.4.1	Hybridization of Complementary Evolutionary Algorithms	7
1.4.2	Hybridization of Chaos/Cloud Theories with Evolutionary Algorithms	8
1.4.3	Combination of Recurrent/Seasonal Mechanisms with Evolutionary Algorithms	9
1.4.4	Summary: Electric Load Forecasting Support System (ELFSS)	11
1.5	Structure of This Book	12
	References	15
2	Modeling for Energy Demand Forecasting	21
2.1	Autoregressive Integrated Moving Average Model	22
2.2	Seasonal Autoregressive Integrated Moving Average Model	23
2.3	Holt–Winters Model	24
2.4	Seasonal Holt–Winters (SHW) Model	25
2.5	General Regression Neural Network Model	26
2.6	Back-Propagation Neural Networks Model	27
2.7	Support Vector Regression Model	30
2.7.1	Structural Risk Minimization	30
2.7.2	Support Vector Regression	32
2.7.3	The Role of Evolutionary Algorithms	35
	References	39

3	Evolutionary Algorithms in SVR's Parameter Determination	41
3.1	Data Set and Forecasting Comparison Statistical Tests	41
3.1.1	Data Set	41
3.1.2	Forecasting Comparison Statistical Tests	43
3.2	Modeling and Forecasting Results of Alternative Models	45
3.2.1	ARIMA Model	45
3.2.2	Holt–Winters Model	45
3.2.3	GRNN Model	46
3.2.4	BPNN Model	46
3.3	Genetic Algorithm in SVR's Parameter Determination	48
3.3.1	Operation Procedure of GA	48
3.3.2	GA for Three-Parameter Determination and Forecasting Results	50
3.4	Simulated Annealing Algorithm in SVR's Parameter Determination	53
3.4.1	Operation Procedure of SA Algorithm	53
3.4.2	SA Algorithm for Three-Parameter Determination and Forecasting Results	56
3.5	Hybrid GA with SA in SVR's Parameter Determination	58
3.5.1	Shortcomings of GA and SA	58
3.5.2	Operation Procedure of GA–SA Algorithm	59
3.5.3	GA–SA Algorithm for Three-Parameter Determination and Forecasting Results	62
3.6	Particle Swarm Optimization Algorithm in SVR's Parameter Determination	64
3.6.1	Operation Procedure of PSO Algorithm	64
3.6.2	PSO Algorithm for Three-Parameter Determination and Forecasting Results	68
3.7	Continuous Ant Colony Optimization Algorithm in SVR's Parameter Determination	70
3.7.1	Basic Concept of ACO Algorithm	70
3.7.2	Continuing Transformation	73
3.7.3	Operation Procedure of CACO Algorithm	74
3.7.4	CACO Algorithm for Three-Parameter Determination and Forecasting Results	76
3.8	Artificial Bee Colony Algorithm in SVR's Parameter Determination	79
3.8.1	Behaviors of Real Bees	79
3.8.2	Operation Procedure of ABC Algorithm	81
3.8.3	ABC Algorithm for Three-Parameter Determination and Forecasting Results	83

3.9	Immune Algorithm in SVR's Parameter Determination	85
3.9.1	Operation Procedure of IA	85
3.9.2	IA for Three-Parameter Determination and Forecasting Results	87
	References	90
4	Chaos/Cloud Theories to Avoid Trapping into Local Optimum . . .	93
4.1	Brief Introductions of Chaotic Sequence and Cloud Model . . .	94
4.1.1	Chaos and Mapping Functions	94
4.1.2	Chaotic Sequence by Logistic Mapping Function	96
4.1.3	Basic Concept of Cloud Model	97
4.1.4	Normal Cloud Generator	99
4.2	Chaotic Genetic Algorithm (CGA) in SVR's Parameters Determination	99
4.2.1	Shortcomings of GA and Improved by Chaotic Sequence	99
4.2.2	Operation Procedure of CGA	100
4.2.3	CGA for Three Parameters Determination and Forecasting Results	103
4.3	Chaotic Simulated Annealing Algorithm in SVR's Parameters Determination	105
4.3.1	Shortcomings of SA Algorithm and Improved by Chaotic Sequence	105
4.3.2	Operation Procedure of CSA Algorithm	106
4.3.3	CSA Algorithm for Three Parameters Determination and Forecasting Results	109
4.4	Chaotic Cloud Simulated Annealing Algorithm in SVR's Parameters Determination	111
4.4.1	Shortcomings of CSA Algorithm and Improved by Cloud Theory	111
4.4.2	Operation Procedure of CCSA Algorithm	113
4.4.3	CCSA Algorithm for Three Parameters Determination and Forecasting Results	116
4.5	Chaotic GASA (CGASA) Algorithm in SVR's Parameters Determination	119
4.5.1	Shortcomings of GASA Algorithm and Improved by Chaotic Sequence	119
4.5.2	Operation Procedure of CCSA Algorithm	119
4.5.3	CGASA Algorithm for Three Parameters Determination and Forecasting Results	122
4.6	Chaotic PSO (CPSO) Algorithm in SVR's Parameters Determination	125
4.6.1	Shortcomings of PSO Algorithm and Improved by Adaptive Inertia Weight Factor and Chaotic Local Search	125

4.6.2	Operation Procedure of CPSO Algorithm	126
4.6.3	CPSO Algorithm for Three-Parameter Determination and Forecasting Results	130
4.7	Chaotic Ant Swarm Optimization Algorithm in SVR's Parameters Determination	133
4.7.1	Shortcomings of CACO Algorithm and Improved by Chaotic Sequence	133
4.7.2	Operation Procedure of CAS Algorithm	134
4.7.3	CAS Algorithm for Three Parameters Determination and Forecasting Results	137
4.8	Chaotic Artificial Bee Colony Algorithm in SVR's Parameters Determination	140
4.8.1	Shortcomings of Chaotic Artificial Bee Colony Algorithm and Improved by Chaotic Sequence	140
4.8.2	Operation Procedure of Chaotic Artificial Bee Colony Algorithm	141
4.8.3	CABC Algorithm for Three Parameters Determination and Forecasting Results	143
4.9	Chaotic Immune Algorithm in SVR's Parameters Determination	146
4.9.1	Shortcomings of IA and Improved by Chaotic Sequence	146
4.9.2	Operation Procedure of CIA	147
4.9.3	CIA for Three Parameters Determination and Forecasting Results	150
	References	153
5	Recurrent/Seasonal Mechanism to Improve the Accurate Level of Forecasting	157
5.1	Combined Mechanisms	157
5.1.1	Recurrent Mechanism	157
5.1.2	Seasonal Mechanism	160
5.2	Seasonal ARIMA Model and Seasonal HW (SHW) Model	162
5.2.1	SARIMA Model	162
5.2.2	SHW Model	163
5.3	Seasonal Mechanism in SVRCGA Model and Forecasting Results	165
5.4	Seasonal Mechanism in SVRCSA Model and Forecasting Results	166
5.5	Seasonal Mechanism in SVRCCSA Model and Forecasting Results	169
5.6	Seasonal Mechanism in SVRCGASA Model and Forecasting Results	172
5.7	Seasonal Mechanism in SVRCPSO Model and Forecasting Results	174
5.8	Seasonal Mechanism in SVRCAS Model and Forecasting Results	176

- 5.9 Seasonal Mechanism in SVRCABC Model and Forecasting Results 179
- 5.10 Recurrent and Seasonal Mechanisms in SVRCABC Model and Forecasting Results 182
- 5.11 Seasonal Mechanism in SVRCIA Model and Forecasting Results 186
- References 189



<http://www.springer.com/978-1-4471-4967-5>

Intelligent Energy Demand Forecasting

Hong, W.-C.

2013, XIII, 189 p., Hardcover

ISBN: 978-1-4471-4967-5