

An Introduction to Fuzzy Logic for Practical Applications

Kazuo Tanaka

Translated by **Tak Niimura**

With 82 Illustrations



Springer

Contents

1. Introduction	1
1.1. What is Fuzzy Logic?	1
1.2. Structure of This Book	3
References	3
2. Fuzzy Set Theory	5
2.1. Fuzzy Sets	5
2.2. Fundamental Operations of Fuzzy Sets—Union, Intersection, and Complement	23
2.3. α -Cuts and Decomposition Principle	30
2.4. Fuzzy Numbers and the Extension Principle	34
2.5. Application Examples of Fuzzy Sets	44
References	50
3. Fuzzy Relations	51
3.1. Fuzzy Relations	51
3.2. Operations of Fuzzy Relations	62
3.3. Composition of Fuzzy Relations	68
3.4. Application Examples of Fuzzy Relations	76
References	80
4. Fuzzy Reasoning	81
4.1. Classification of Fuzzy Reasoning	81
4.2. Mechanism of Fuzzy Reasoning	84
4.3. Method 1: Mamdani's Direct Method	86
4.4. Method 2: Fuzzy Reasoning Using Linear Functions	108
4.5. Method 3: Simplified Fuzzy Reasoning	113
4.6. Application Example of Fuzzy Reasoning	113
References	119

5. Fuzzy Logic Control	121
5.1. What is Fuzzy Logic Control?	121
5.2. Designing Fuzzy Logic Controllers	122
5.3. Application Examples of Fuzzy Reasoning	130
References	136
Index	137