



Thermoeconomic Diagnosis of Energy Systems

Sergio Usón y Antonio Valero

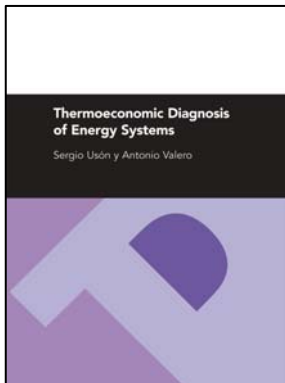
Prensas Universitarias de Zaragoza

Textos Docentes, 190

2010, 112 pp., 17 x 23, Rústica

ISBN 978-84-15031-86-4

10 euros



The aim of this book is to describe the main thermoeconomic diagnosis procedures developed. In chapter 2, the concepts and tools provided by Thermoeconomics for dealing with the diagnosis problem are presented and applied to an example. The aim of chapter 3 is to describe three diagnosis methods based on thermodynamic indicators: quantitative causality analysis, linear regression and neural networks. In chapters 5 and 6, these methods are applied to the diagnosis of an operating plant, which has been described in chapter 4. In order to complete the picture of thermoeconomic diagnosis, an overview of methods and systems is made in chapter 7.

Table of contents

1. INTRODUCTION.....	7
2. THERMOECONOMICS AND DIAGNOSIS.....	9
2.1. Fundamentals of Thermoconomics and its application to diagnosis .	9
2.1.1. Exergy analysis	9
2.1.2. Thermo-economic analysis fundamentals	10
2.1.3. Application of Thermoconomics to diagnosis	12
2.1.3.1. Irreversibility and diagnosis	12
2.1.3.2. The Fuel Impact Formula	13
2.1.3.3. Malfunction and dysfunction analysis	13
2.1.4. Cost formation of wastes (or residues)	14
2.2. Example of application	16
2.2.1. Description of the example	16
2.2.2. Thermo-economic analysis	19
2.2.3. Thermo-economic diagnosis	22
2.3. Closure	24
3. THERMOECONOMIC DIAGNOSIS BASED ON THERMODYNAMIC INDICATORS.....	27
3.1. Quantitative causality analysis	27
3.1.1. Formulation of the method	27
3.1.2. Example of application	29
3.2. Linear regression, neural networks and thermo-economic diagnosis .	34
3.2.1. Linear regression fundamentals	34
3.2.2. Neural network fundamentals	36
3.2.2.1. Neurons, layers and networks	36
3.2.2.2. Feedforward networks and backpropagation	40
3.2.3. Application for thermo-economic diagnosis	41
3.3. Closure	42
4. EXAMPLE OF APPLICATION: TERUEL POWER PLANT.....	43
4.1. Teruel power plant description	43
4.1.1. Steam cycle description	43
4.1.2. Cooling system	46
4.1.3. Boiler	47
4.2. Diagnosis model for Teruel power plant	51
4.2.1. Free diagnosis variables	51
4.2.2. Global efficiency indicators	54
4.3. Closure	54

5. APPLICATION OF QUANTITATIVE CAUSALITY ANALYSIS TO THE DIAGNOSIS OF TERUEL POWER PLANT	55
5.1. The SDG diagnosis system	55
5.2. Evolution of efficiency indicators	56
5.3. Diagnosis results	59
5.4. Residual analysis	68
5.5. Closure	70
6. APPLICATION OF LINEAR REGRESSION AND NEURAL NETWORKS TO THE DIAGNOSIS OF TERUEL POWER PLANT	73
6.1. Linear regression	73
6.1.1. Variable change	74
6.1.2. Results	75
6.2. Neural networks	78
6.2.1. Neural network definition and training	79
6.2.2. Results	83
6.3. Closure	86
7. OVERVIEW OF THERMOECONOMIC DIAGNOSIS METHODOLOGIES AND SYSTEMS	87
7.1. Thermoeconomic diagnosis methodologies	87
7.1.1. Application of thermoeconomic indicators with filtration of the effects induced by the control system	88
7.1.2. Other methods based on the use of thermoeconomic indicators and filtration of induced effects	90
7.1.3. Representation of the malfunctions in the h-s plane	91
7.1.4. Methods based on thermodynamic indicators	94
7.1.5. Hybrid methods	95
7.1.6. Other examples	74
7.2. State of the art of system for diagnosis and other related issues	97
7.2.1. Diagnosis systems in general	97
7.2.2. Diagnosis centres and manufacturer-operator collaboration ...	99
7.2.3. Monitoring, diagnosis and optimization of boilers	99
7.2.4. Other issues	100
7.3. Closure	101
REFERENCES	103
TABLE OF CONTENTS	111