

Preface

During the last 30 years, considerable research effort has been devoted to improve the efficiency of solar power plants from the control and optimization viewpoint. This book presents techniques to model and control solar energy systems. The book contains results obtained in several solar plants located at the Plataforma Solar de Almería (PSA), South-East Spain, which is the largest European center for research, development and testing of concentrating solar technologies.

The book is mainly aimed at practitioners, both from the solar energy community and the control engineering community, although it can be followed by a wide range of readers, as only basic knowledge of control theory and sampled data systems is required.

The book is organized as follows: Chap. 1 gives a brief introduction to solar energy fundamentals, including solar radiation related concepts and a classification of solar thermal technologies and energy storage systems. Chapter 2 presents control issues in solar systems, where the main Sun tracking mechanisms are studied, a brief overview of solar radiation estimation and forecast techniques is included, the control of fundamental variables is explained, as well as how the integrated control of solar energy systems should be addressed. Chapter 3 briefly introduces the photovoltaic plants, focused on automatic tracking strategies. Chapter 4 explains the basic modeling and control approaches related to thermal solar plants with parabolic trough distributed collectors. After reviewing different modeling approaches for these kinds of system, the basic control algorithms are explained, highlighting their main advantages and drawbacks: feedforward control, PID control and cascade control. In Chap. 5, parabolic troughs advanced control techniques are developed, covering a wide range of control schemes that have been tested at the PSA following a classification of these techniques. Some of these strategies are adaptive control, model-based predictive control, nonlinear control, fuzzy logic control and so on. Chapter 6 deals with the control of power towers with central receiver systems. After explaining the main control issues of these kinds of plant, including a general description of the control system, and types of receiver and model, both the heliostat field control and aiming strategies are explained, including basic control approaches. Chapter 7 briefly explains the main control issues related to other

interesting solar energy applications, such as solar furnaces and solar refrigeration systems. Finally, Chap. 8 presents recent approaches to the integrated control of solar systems.

The text is composed of material collected from articles written by the authors, technical reports and lectures given to graduate students.

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