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Keynote

Control of solar energy plants

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Abstract

The use of renewable energy, such as solar energy, experienced a great impulse during the second half of the seventies just after the first big oil crisis. At that time economic issues were the most important factors and the interest in these types of processes decreased when the oil prices fell. There is a renewed interest in the use of renewable energies nowadays driven by the need of reducing the high environmental impact produced by the use of fossil energy systems. There are two main drawbacks of energy systems: a) the resulting energy costs are not yet competitive and b) solar energy is not always available when needed. Considerable research efforts are being devoted to techniques which may help to overcome these drawbacks, control is one of those techniques. A thermal solar power plant basically consists of a system where the solar energy is collected, then concentrated and finally transferred to a fluid. The thermal energy of the hot fluid is then used for different purposes such as generating electricity, the desalination of sea water etc. While in other power generating processes, the main source of energy (the fuel) can be manipulated as it is used as the main control variable, in solar energy systems, the main source of power which is solar radiation cannot be manipulated and furthermore it changes in a seasonal and on a daily base acting as a disturbance when considering it from a control point of view. Solar plants have all the characteristics needed for using advanced control strategies able to cope with changing dynamics, (nonlinearities and uncertainties). As fixed PID controllers cannot cope with some of the mentioned problems, they have to be detuned with low gain, producing sluggish responses or if they are tightly tuned they may produce high oscillations when the dynamics of the process vary, due to environmental and/or operating conditions changes. The use of more efficient control strategies resulting in better responses would increase the number of operational hours of the plants. The talk describes the main solar thermal plants, the control problems involved and how control systems can help in increasing their efficiency. Some illustrative examples will be given.

Biography

Prof. Eduardo F. Camacho has a doctorate in Electrical Engineering from the University of Seville, where he is now professor of the Department of System Engineering and Automatic Control. Currently, he is an IFAC fellow (2009), an IEEE fellow (2012), editor of Control Engineering Practice, editor at large of the European Journal of Control, and Subject editor of Optimal Control: Applications and Methods. He received the Javier Benjumea award (2012) for his contributions in Model Predictive Control and solar energy systems. He has acted as evaluator of projects at national and European level. He was appointed for four years Manager of the Advanced Production Technology Program of the Spanish National R&D Program. He was one of the Spanish representatives on the Program Committee of the Growth Research program and national expert for the Program Committee of the NMP research priority of the European Union. He has written seven books related to Advanced Control Strategies, among them, “Control of Solar Energy Systems” (2012) published by Springer Verlag. His main research interest are in the areas of model predictive control and solar energy, areas where he has participated and coordinated many research projects and authored and co-authored more than 200 papers in journals and conferences. He has around 10000 citations to his publications (Google Scholar).