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Index Terms

Knowledge-based control; Real-time algorithms, scheduling, and programming; Adaptive neural and fuzzy control

Abstract

Solar power plants collect available thermal energy in a usable form at the desired temperature range. Efficient operation requires a fast start-up and reliable operation in varying cloudy conditions without unnecessary shutdowns and start-ups. Fast and well damped linguistic equation (LE) controllers have been tested in Spain at a collector field, which uses parabolic-trough collectors to supply thermal energy in form of hot oil to an electricity generation system or a multi-effect desalination plant. Control is achieved by means of varying the flow pumped through the pipes in the field during the operation. The nights and the heavy cloud periods need to come up with the storage. The smart LE controllers extend the operation to varying cloudy conditions and handle efficiently disturbances in energy demand. The predefined model-based adaptation techniques are combined with special features when needed. The intelligent state indicators react well to the changing operating conditions and can be used in smart working point control to further improve the operation in connection with the other energy sources. The controller reacts efficiently on the setpoint changes, clouds and load disturbances. The predictive braking action allows fast changes in control actions. The setpoint is achieved accurately with the new asymmetrical action. The working point can be chosen in a way which improves the efficiency of the energy collection.

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