

温室环境多级控制系统及优化目标值设定的初步研究

Preliminary study on hierarchical greenhouse environment control system and setting of the optimized target values

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英文关键词: greenhouse; hierarchical control system; the theory of integrated temperature; photosynthesis rate; genetic algorithm

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中文摘要:

该文采用多级控制策略, 优化设定系统目标值来解决温室环境系统中多个时间响应常数相差过大的问题; 设定系统优化目标值时, 白天使植物获得最大的光合速率, 夜间在满足植物生长和积温要求的前提下使温室处在能耗最小的状态下运行。构建了能量消耗为零(无加热、无制冷和无机械通风)时计算温室内部温度的模型, 采用遗传算法对最优目标值进行搜索。计算结果表明: 该系统优于某地先进的温室控制系统, 既能获得较高的效率又能节能。

英文摘要:

In order to solve the problem of many time scales, a hierarchical greenhouse environment control system was designed. In the system from lower to higher there were three sub-systems: measuring and controlling layer, optimal process layer and supervising layer. Plant environment optimal control strategies in intelligent greenhouse were researched so as to get the best photosynthesis rate and at the same time cut down energy consumption. In the daytime the optimal goals were decided according to the maximal photosynthesis rate principle. In the nighttime on better plant growth conditions the optimal goals were decided by energy saving principle. The object function was constructed by forecasting greenhouse inside temperature in case of no energy used and by the theory of integrated temperature. The optimal target values were computed by genetic algorithm. Compared with the optimal result and recording data in real system, the method was reasonable and could achieve energy saving and the maximal photosynthesis rate in case of restrained light.

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