A SOFT-SENSOR FOR ON-LINE ESTIMATION OF VENTILATION OF A GREENHOUSE

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Abstract
In modern greenhouses vents' opening is controlled as a mean to regulate temperature and humidity within the house. There is an effect as well on carbon dioxide concentration inside, since in greenhouses with active CO2 fertilisation the concentration set-point is lowered with vents opening whereas, in the absence of fertilisation, the CO2 concentration results from the balance of assimilation and inflow through the vents. A good estimate of the ventilation rate, by allowing foreknowledge of the effect of an action, would much improve the efficacy of the interlinked control of temperature, humidity and [CO2] through the single action of vents' opening. However, the effect obtained by a given action (that is, the amount of energy, vapour and CO2 that are exchanged with the outside world) depends in a complex way from the geometry of the vents, the amount of opening, wind speed and direction, and temperature and humidity difference between in- and outside. Therefore models to calculate the ventilation rate of greenhouses require many specific parameters and are as complex as to be of little practical use (aside from design purposes).
In this work we describe an innovative method–a "soft-sensor"–to estimate on-line the ventilation rate from data that are routinely collected by a climate control computer. The method is based on the computational technique of the "unknown input observer". We show that, in spite of being developed and tested with Dutch Venlo greenhouses, the method can be successfully applied to the quite different greenhouse structures and climate conditions of The Mediterranean basin. We use a couple of selected examples to discuss how this method could be applied to improve management in such conditions.