

Modeling and Simulation Application for Greenhouse Microclimatic Studies and Structural Analysis

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Abstract

Microclimate of greenhouse plays a vital role in better plant growth and production. The microclimate dynamics inside the greenhouse, shade net house depends upon the surrounding ambient climatic condition as well as the heat and moisture transport process between the greenhouse and the surroundings. Microclimate modeling is needed in order to understand and simplify the thermodynamic process occurring inside the greenhouse or other protected cultivation structures like shade net house, ploy tunnel, etc. and thereafter to control the microclimate by several controlling actions like ventilation, heating or cooling, maintenance of CO₂ concentration and light condition in order to provide suitable condition for growing of crops. Optimal ambient control is needed for greenhouse energy balance, which also includes the reduction of production costs. Greenhouse structures are mainly lightweight structures that are subjected to dead load, live load, and wind load. Structural analysis of the greenhouse is critical to select the optimum size of structural components to select a structurally and economically suitable greenhouse design. This chapter deals with the information available on microclimate modeling, climate control, and structural analysis and design of the greenhouse.

Keywords: Microclimate modeling, Thermodynamic process, Structural analysis, Greenhouse

1. Introduction

A greenhouse defined as a “framed or an inflated structure with a transparent or