Foreword

It is my great honor and pleasure to write the foreword of this excellent book entitled “Digital Controlled Environment Agriculture Engineering” . The author, Dr. Wei Fang, is an internationally well-known professor who has been a leader in controlled environment agriculture (e.g., greenhouses and plant factories with artificial lighting) both in academia and industry. His wide and in-depth knowledge and experiences with positive thinking and a warm heart have been attracting numerous people. I have known him for more than 35 years and met him probably more than 100 times at different places since 1986, and learned many things in many aspects through conversation, oral presentations, and papers.

Dr. Fang is a real professional in mathematics, modeling, programming, simulation, and their applications in the design and management of controlled environment agriculture. To develop the mechanistic mathematical models, a wide range of scientific and engineering knowledge is required including mass (substance) and energy balance, psychrometrics of moist air, radiation spectra and their effects on plant physiology and morphology, photosynthesis, respiration, transpiration, evaporation, and dry matter accumulation and leaf area growth of plants.

A unique feature of this book is that all the equations used in the models are expressed in MATLAB, a programming and numeric computing platform used by millions of engineers, scientists, and students. The users can enjoy the results of simulations graphically and/or in a tabular form simply by changing the parameter values in the MATLAB models. This feature helps horticultural people to understand the behavior of models under various conditions without fully understanding mathematical relationships among the variables used in the models and making efforts for computer programming. On the other hand, engineering people can save much time understanding and programming the complicated mechanisms of plant physiology, psychrometrics of moist air, etc. As far as I know, Dr. Fang is the best researcher in the world to write such a book because he has written many papers and has given a series of lectures on these topics for many years. The readers can challenge to apply the MATLAB models presented in this book to solve any issue on controlled environment agriculture. This book is useful not only for researchers and students, but also educators, policymakers, business people, and citizens to understand the principles, methodology, and roles of controlled environment agriculture.

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個人感到非常榮幸與高興，有機會為這本《數位化環控農業工程學》的優秀著作撰寫序言。作者方煒博士是國際知名教授，在學術界和產業界一直是環控農業（包括溫室和人工光型植物工廠）的領軍人物。他廣泛精實的知識和經歷，積極的思考和熱情，吸引了無數人。我認識他已經超過 35 年，自 1986 年以來在不同的地方見過他大概 100 多次，通過交談、口頭報告和論文，在很多方面學習/交流了很多東西。

方博士是數學、建模、編程、模擬及其在環控農業工程系統設計和管理中的應用的真正專家。要開發數學模式，需要廣泛的科學和工程知識，包括質量和能量平衡、濕空氣熱力學、輻射光譜及其對植物生理和形態、光合作用、呼吸作用、蒸騰作用、蒸發作用，乾物質積累和葉面積增長的影響。

本書的一個獨特之處在於，模式中使用的所有計算式均以 MATLAB 來呈現，MATLAB 是數百萬工程師、科學家和學生使用的編程和數值計算平台。使用者只需更改 MATLAB 模式中的參數值，即可以圖形和/或表格形式享受模擬/仿真的結果。此功能有助於園藝人員了解模式在各種條件下的行為，而無需完全理解模式中使用的變量之間的數學關係並進行計算機編程。另一方面，工程人員可以節省很多時間來理解和編程植物生理學、濕空氣熱力學等複雜機制。據我所知，方博士是世界上寫這樣一本書的最好的研究人員，因為多年來，他撰寫了許多論文，並就這些主題發表了一系列演講。讀者可以挑戰應用本書中介紹的 MATLAB 模式來解決環控農業的任何問題。這本書不僅對研究人員和學生有用，對教育工作者、決策者、商人和一般民眾了解環控農業的原理、方法和作用也很有用。

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