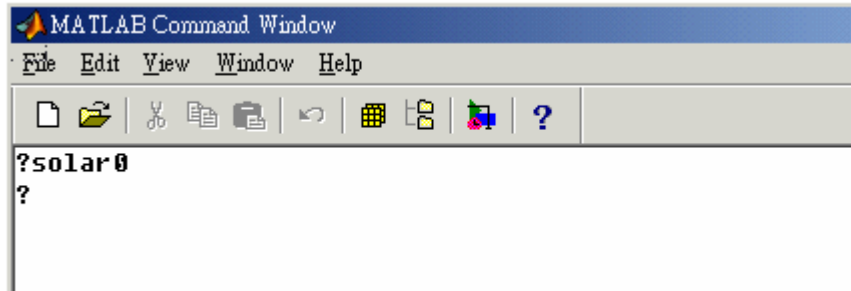


# Introduction of MATLAB program for Solar Engineering Fundamentals

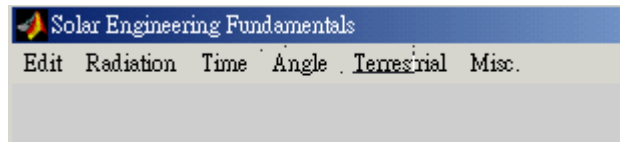
Wei Fang, Ph.D., Professor  
Dept. of Bio-Industrial Mechatronics Engineering  
National Taiwan University, ROC

## 1. Program execution

Enter 'solar0' in the command window to execute the program.



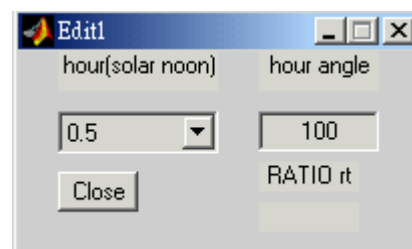
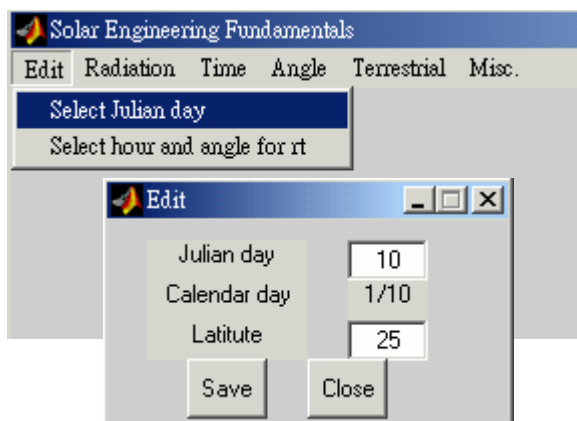
A window with 6 options in the main menu will pop up from the monitor as shown below. The 6 options are: Edit, Radiation, Time, Angle, Terrestrial and Misc..



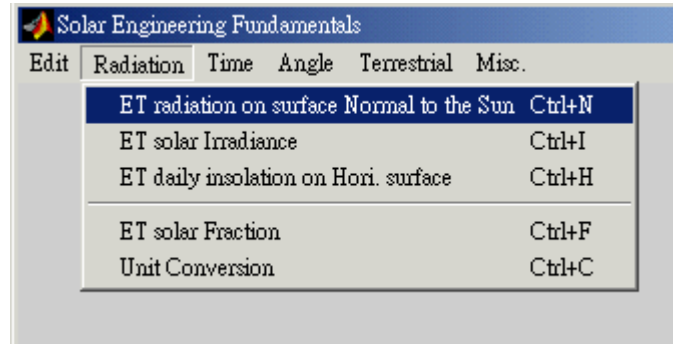
## 2. Main menu

### 2.1. Edit

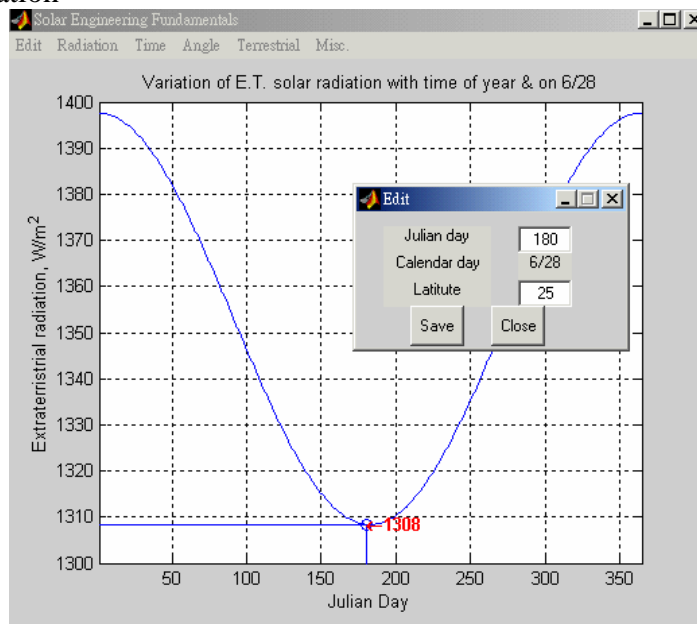
The first option provides 'Edit' function, allows users to set the date and latitude for further calculation. Users can enter a value between 1 to 365 for the cell following 'Julian day' and enter the latitude for the location of interest. The program will calculate the corresponding calendar day and displayed as shown in the figure. The information of the latitude will be discussed further in section 2.5.1.



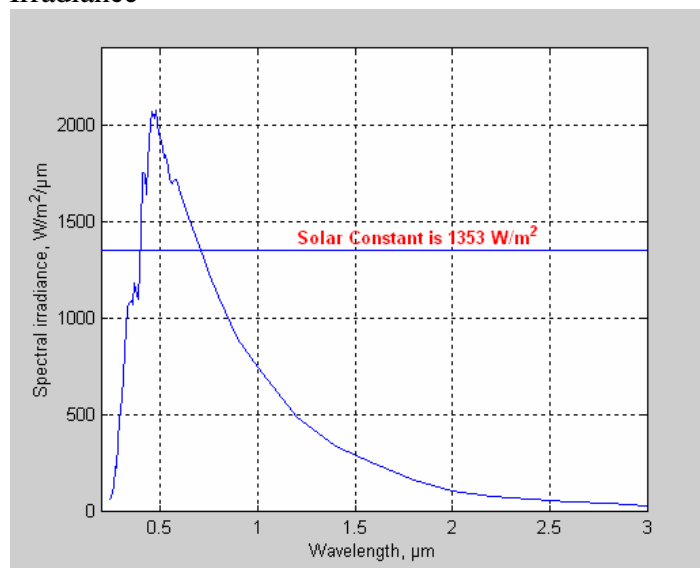
## 2.2. Radiation



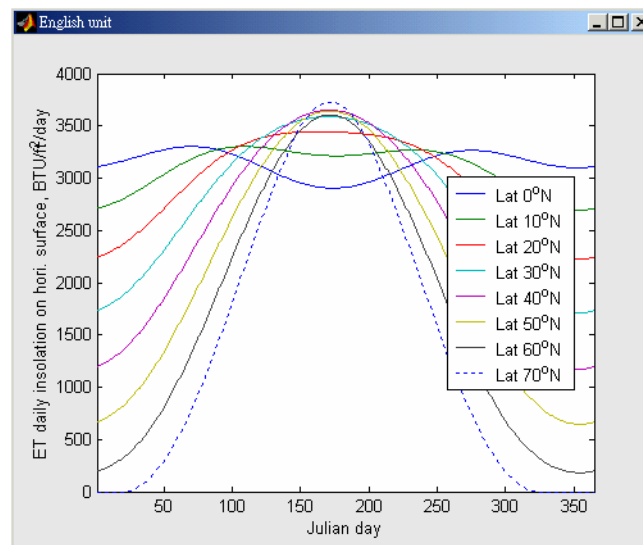
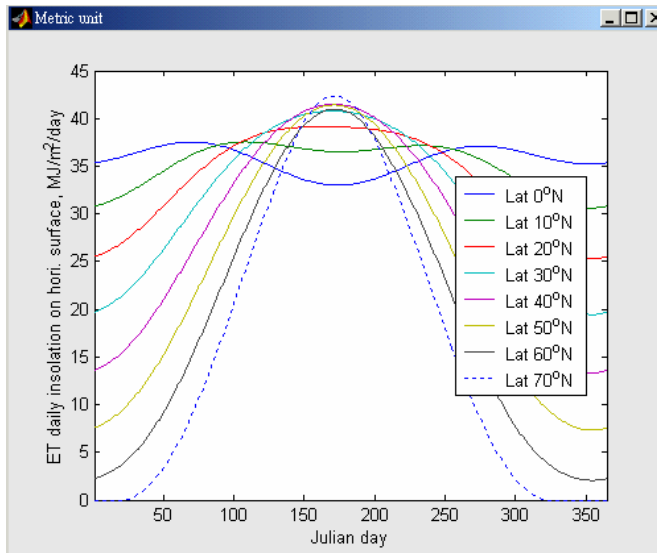
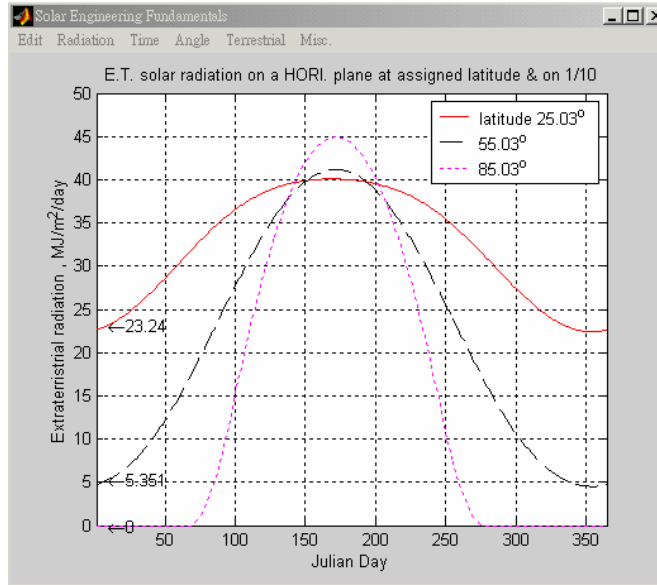
### 2.2.1. ET Radiation



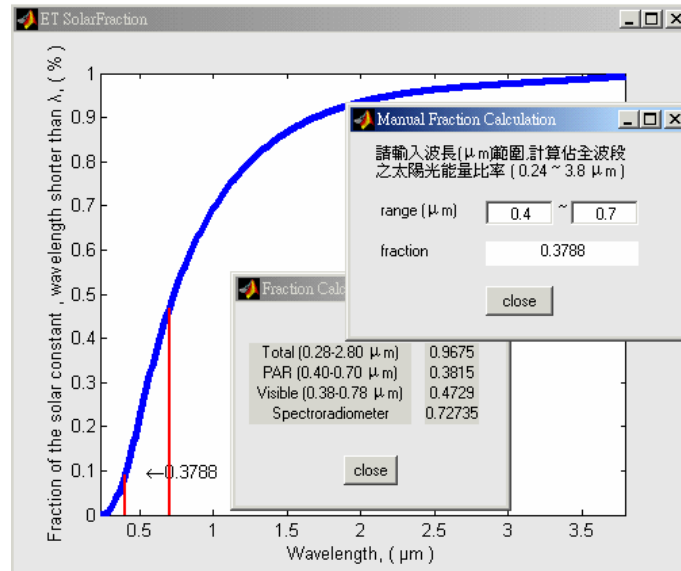
### 2.2.2. ET Solar Irradiance



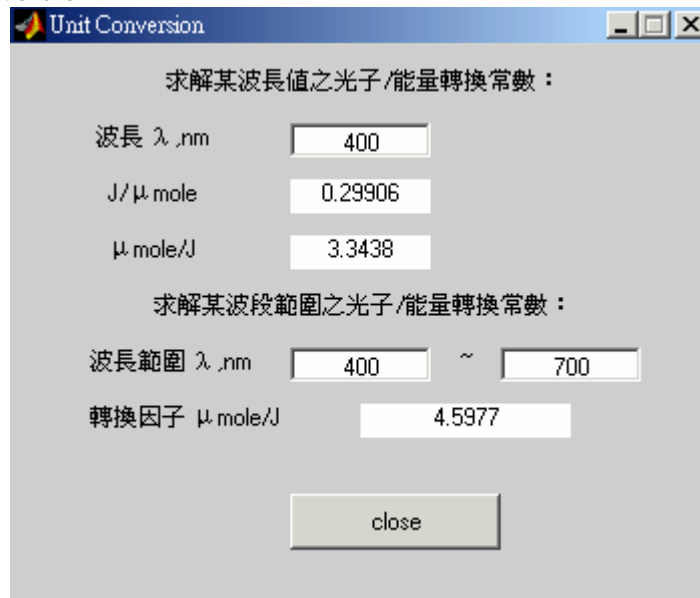
### 2.2.3. ET daily insolation on horizontal surface



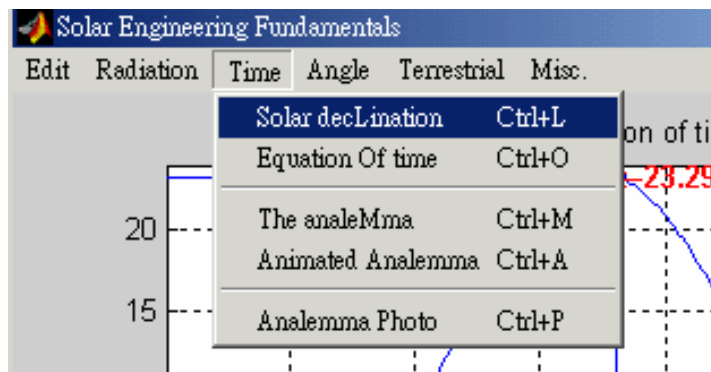
### 2.2.4. ET Solar fraction



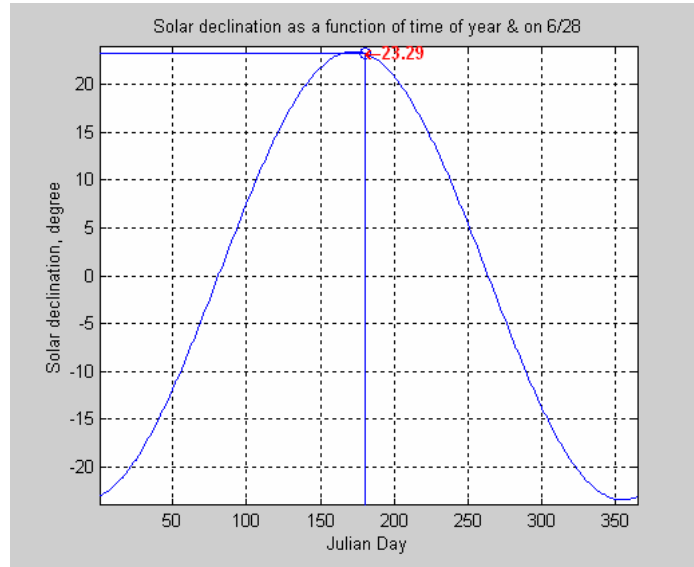
### 2.2.5 Unit Conversion



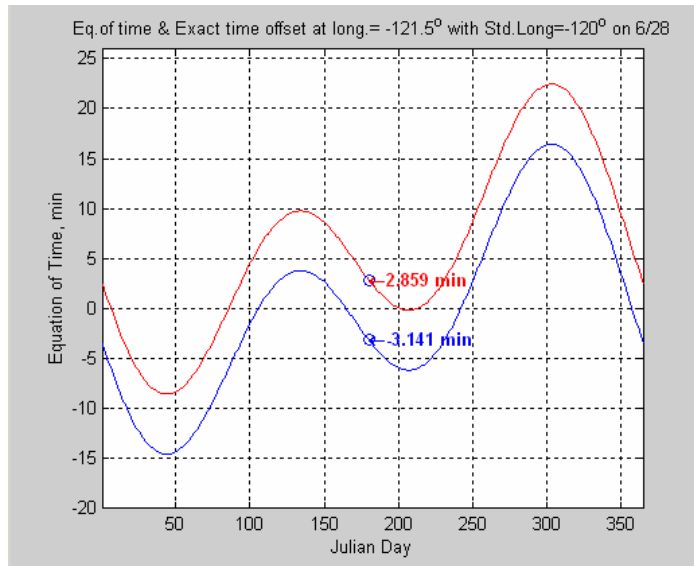
### 2.3. Time



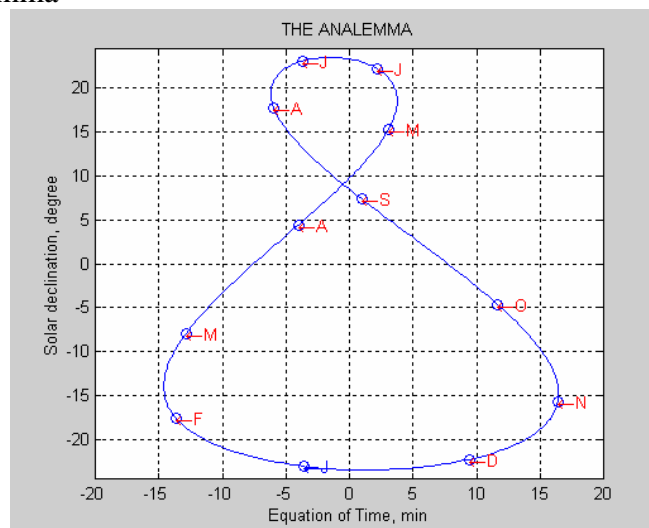
### 2.3.1. Solar declination



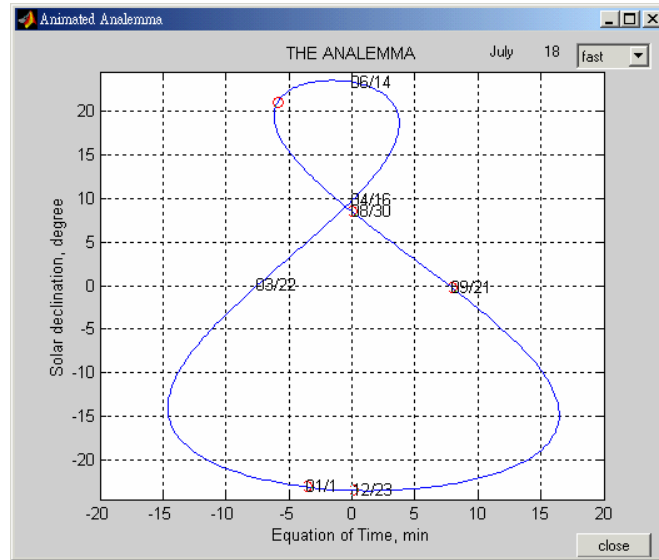
### 2.3.2. Equation of Time



### 2.3.3. The Analemma



### 2.3.4. Animated Analemma

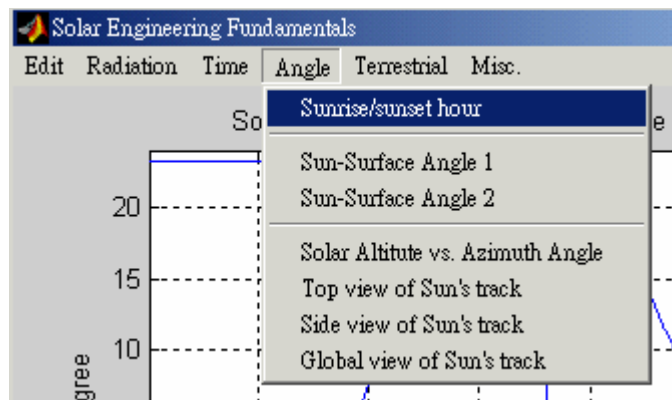


### 2.3.5 Analemma Photo

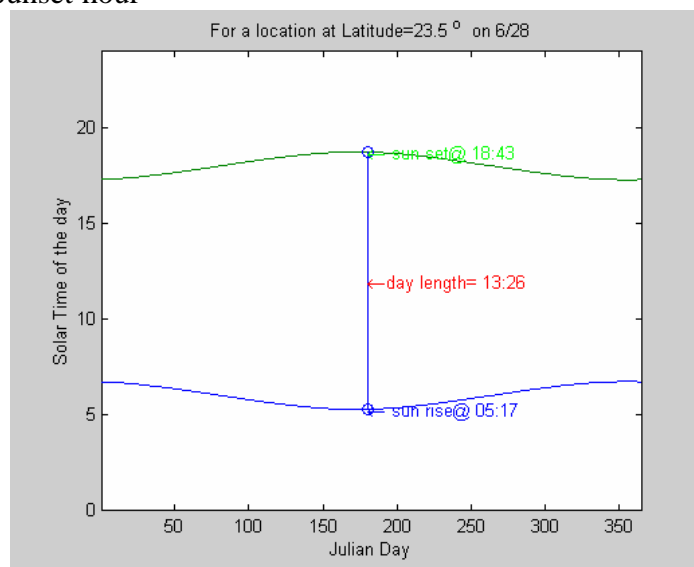




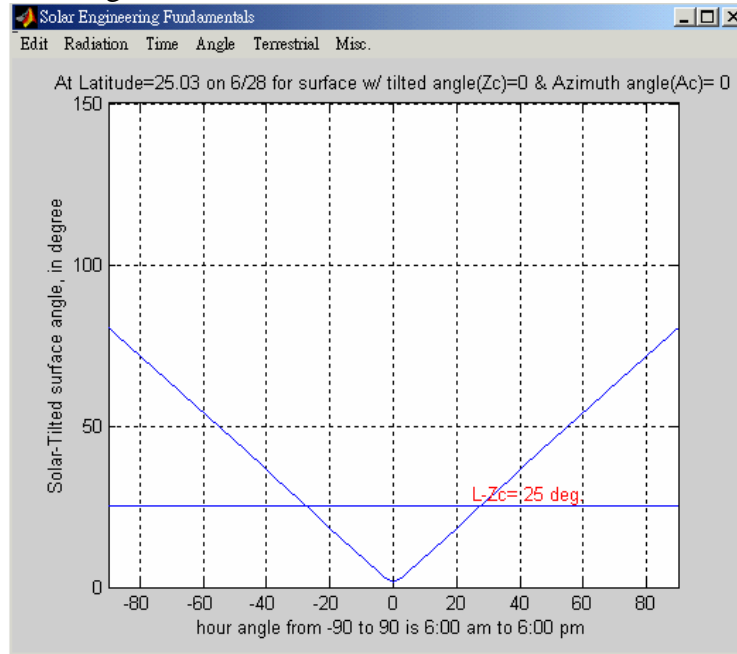
## 2.4. Angle



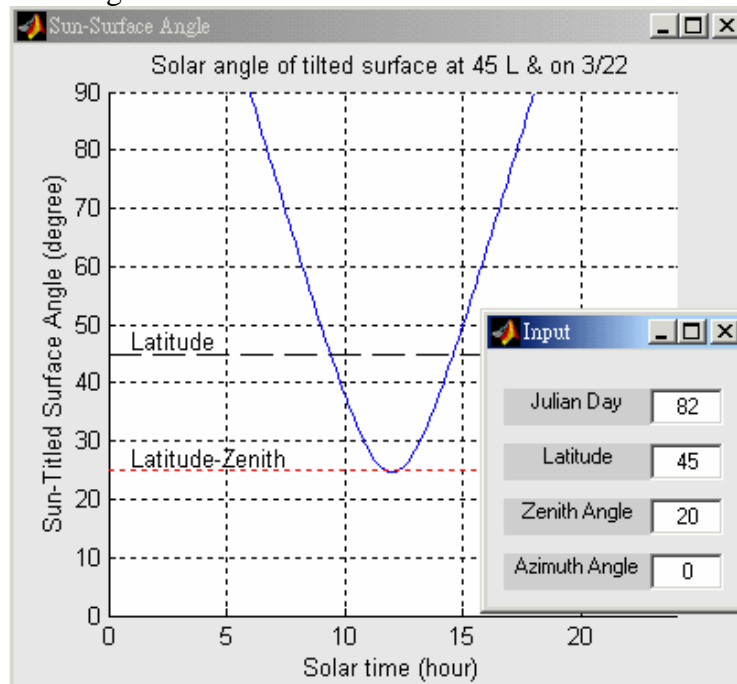
### 2.4.1. Sunrise/Sunset hour



### 2.4.2. Sun-Surface Angle 1

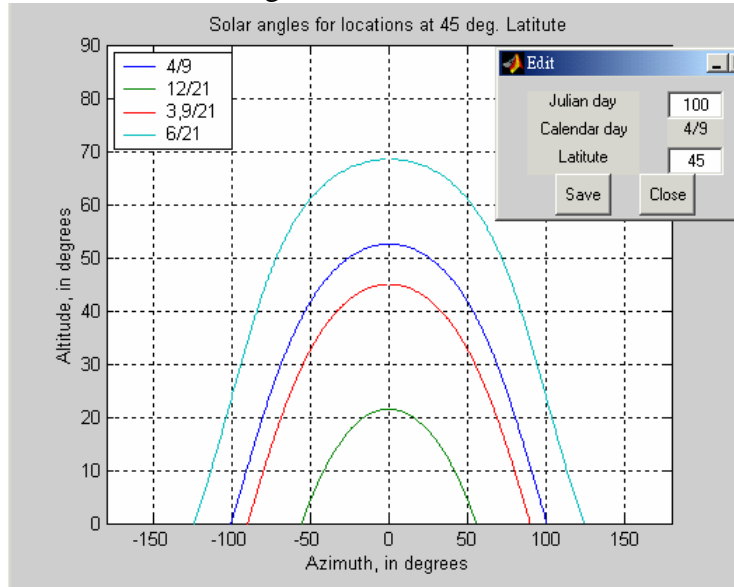


### 2.4.3. Sun-Surface Angle 2

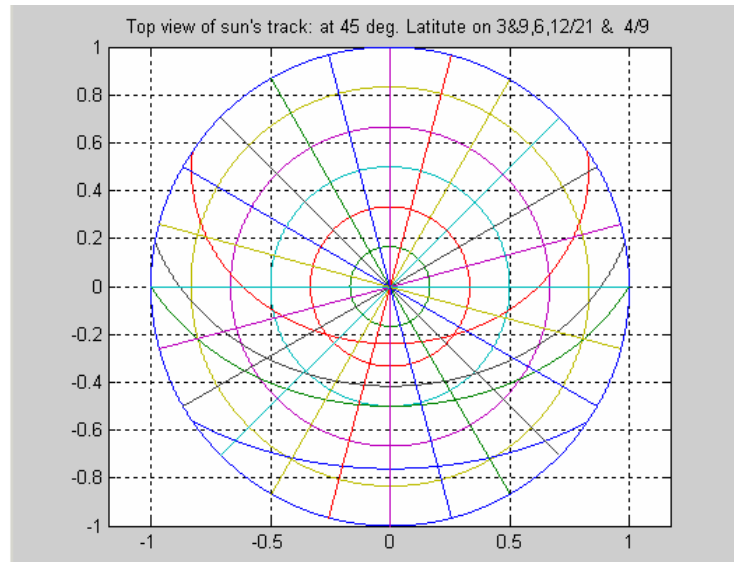




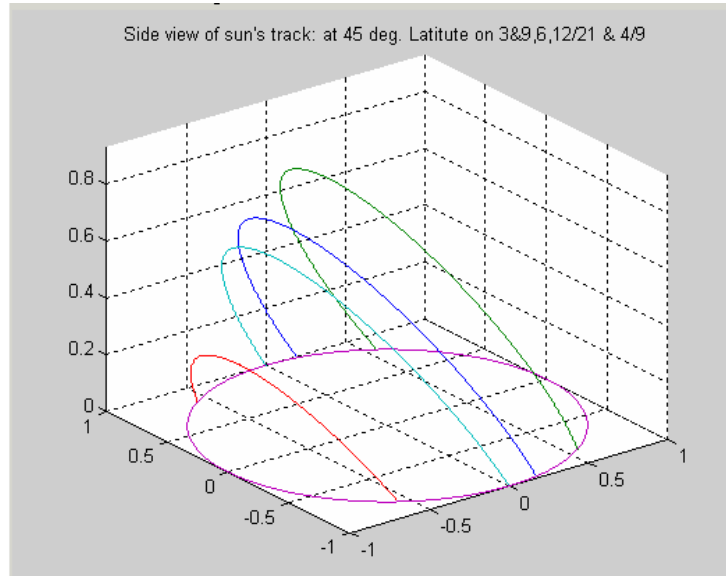
## 2.4.4. Solar altitude vs. azimuth angle



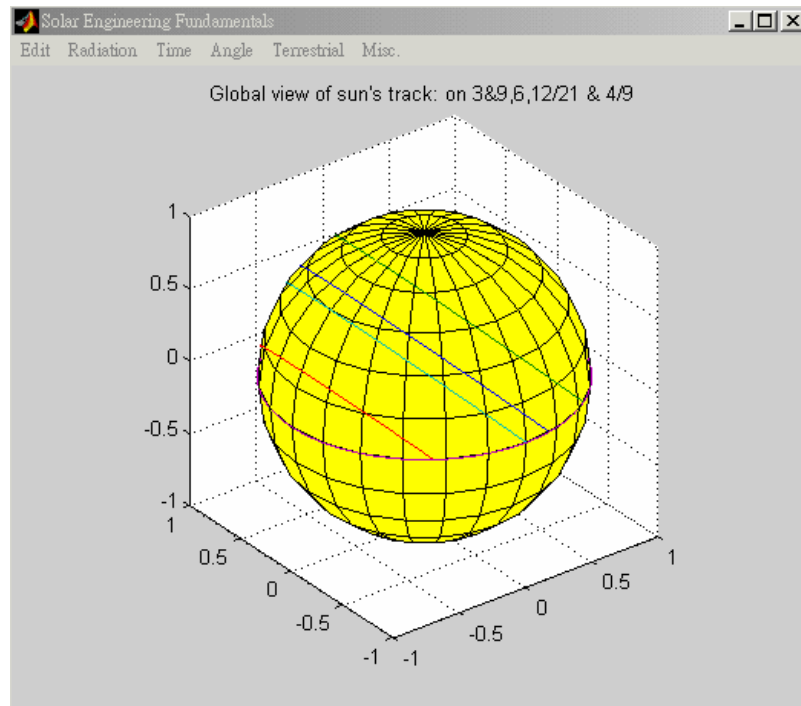
## 2.4.5. Top view of sun's track



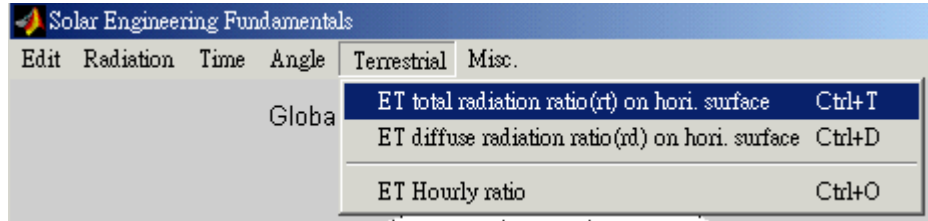
## 2.4.6. Side view of sun's track



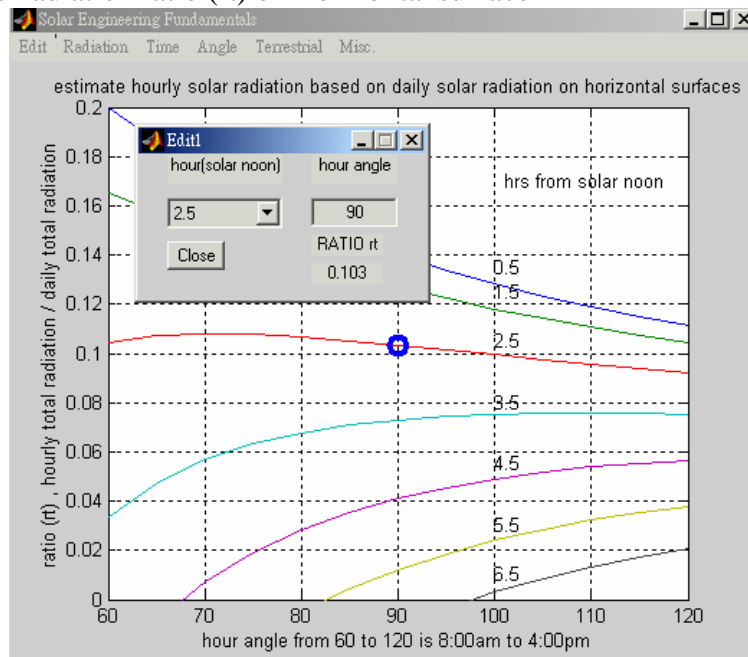
## 2.4.7. Global view of sun's track



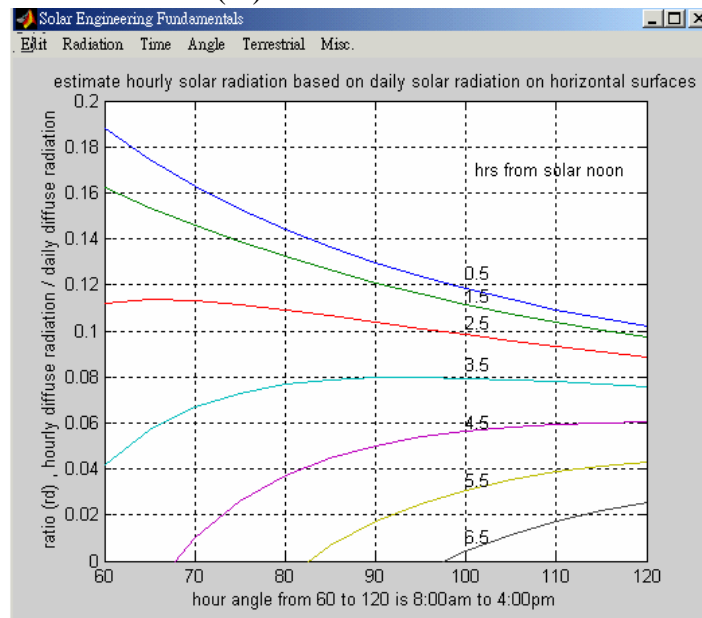
## 2.5. Terrestrial

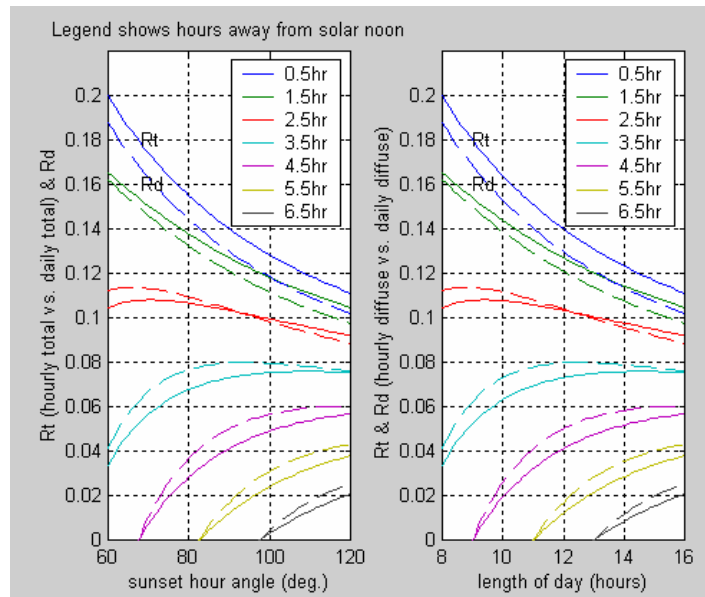


### 2.5.1. ET total radiation ratio (rt) on horizontal surface

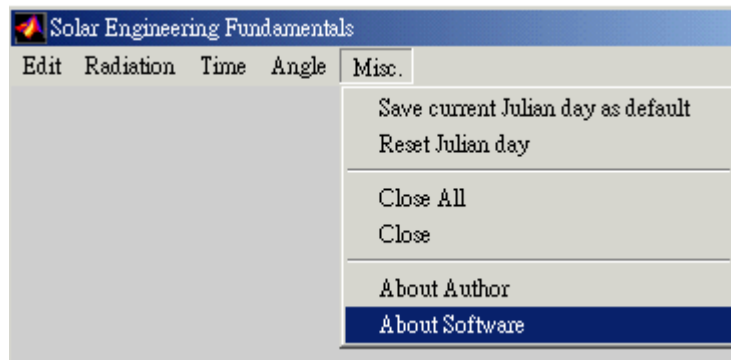


### 2.5.2. ET diffuse radiation ratio (rd) on horizontal surface





## 2.6. Misc.



## 3. Source code

Please download '**solar0.zip**' file from the internet. The zip file contains 3 MATLAB program files, including 'solar0.m', 'analemma.m' and 'Sc\_cal.m', and a default data file, entitled 'solar.txt'.