Introduction of MATLAB program for Solar Engineering Fundamentals

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## 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.



hour angle
ineta angle
100
RATIO rt

## 2.2. Radiation

🛷 Solar Engineering Fundamentals								
Edit	Radiation	Misc.		,				
	ET radiation on surface Normal to the Sun Ctrl+N							
	ET solar Irradiance Ctrl+I							
	ET daily insolation on Hori. surface Ctrl+H							
	ET solar Fraction Ctrl+F							
	Unit Conversion Ctrl+C							

## 2.2.1. ET Radiation



2.2.2. ET Solar Irradiance









# 2.2.4. ET Solar fraction



## 2.2.5 Unit Conversion

📣 Unit Conversion 📃 🗔 🗙
求解某波長値之光子/能量轉換常數:
波長 λ ,nm 400
J/µmole 0.29906
μ mole/J 3.3438
求解某波段範圍之光子/能量轉換常數:
波長範圍 λ ,nm 400 ~ 700
轉換因子 μ mole/J 4.5977
close

## 2.3. Time

🥠 So	lar Engineer	ing Fun	damenta	ls			
Edit	Radiation	Time	Angle	Terrestri	al Mis	xc.	
		Sol	ar decLir	ation	Ctrl+L	on of	tii
	_	Εqu	lation Of	time	Ctrl+C		79
	20	The Ani	e analeM: imated A	ma nalemma	Ctrl+M Ctrl+A	1	
	15	Ana	alemma H	hoto	Ctrl+P		
		:		-17	1		

## 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









2.4.1. Sunrise/Sunset hour





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

📣 Solar Engineering Fundamentals						
Edit	Radiation	Time	Angle	Terrestrial	Misc.	
			Globa	ET total radiation ratio(rt) on hori. surface Ctrl		
			Cioba	ET diffuse radiation ratio (rd) on hori. surface Ctrl+D		
				ET Hourly ratio Ctrl+		Ctrl+O

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









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Edit	Radiation	Time	Angle	Misc.
				Save current Julian day as default
				Reset Julian day
				Close All
				Close
				About Author
				About Software

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'.