

MATLAB EXPO 2017

KOREA

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Introducing the MATLAB Live Editor

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```

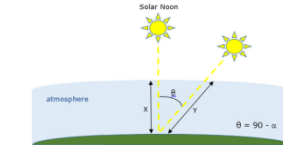
sunrise = timeofday(midnight + hours(sr));
ss = 12 + acosd(-tand(phi)*tand(delta))/15 - solarCorr/60;
sunset = timeofday(midnight + hours(ss));
disp(['Sunrise = ' datestr(sunrise, 'HH:MM:SS') ' Sunset = ' datestr(sunset, 'HH:MM:SS') ])

```

Air Mass and Solar Radiation

Include images to illustrate important points in your story. To include an image from a file, copy and paste an image from another source or go to the **Live Editor** tab and click the **Image** button.

As light from the sun passes through the earth's atmosphere, some of the solar radiation will be absorbed. The air mass is a function of solar elevation (α). As shown in the diagram below, it is a measure of the length of the path of light through the atmosphere (Y) relative to the shortest possible path (X) when the sun's elevation is 90° .



The larger the air mass, the less radiation reaches the ground. The air mass can be calculated from the equation

$$AM = \frac{1}{\cos(90 - \alpha) + 0.5057(6.0799 + \alpha)^{-1.6354}}$$

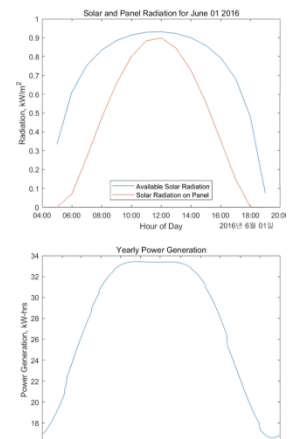
Then the solar radiation (in Kw/m^2) reaching the ground can be calculated from the empirical equation

$$sRad = 1.353 + 0.741^{0.610}$$

```

AM = 1/(cosd(90-alpha) + 0.5057*(6.0799+alpha)^-1.6354);
sRad = 1.353 + 0.741^0.610;

```

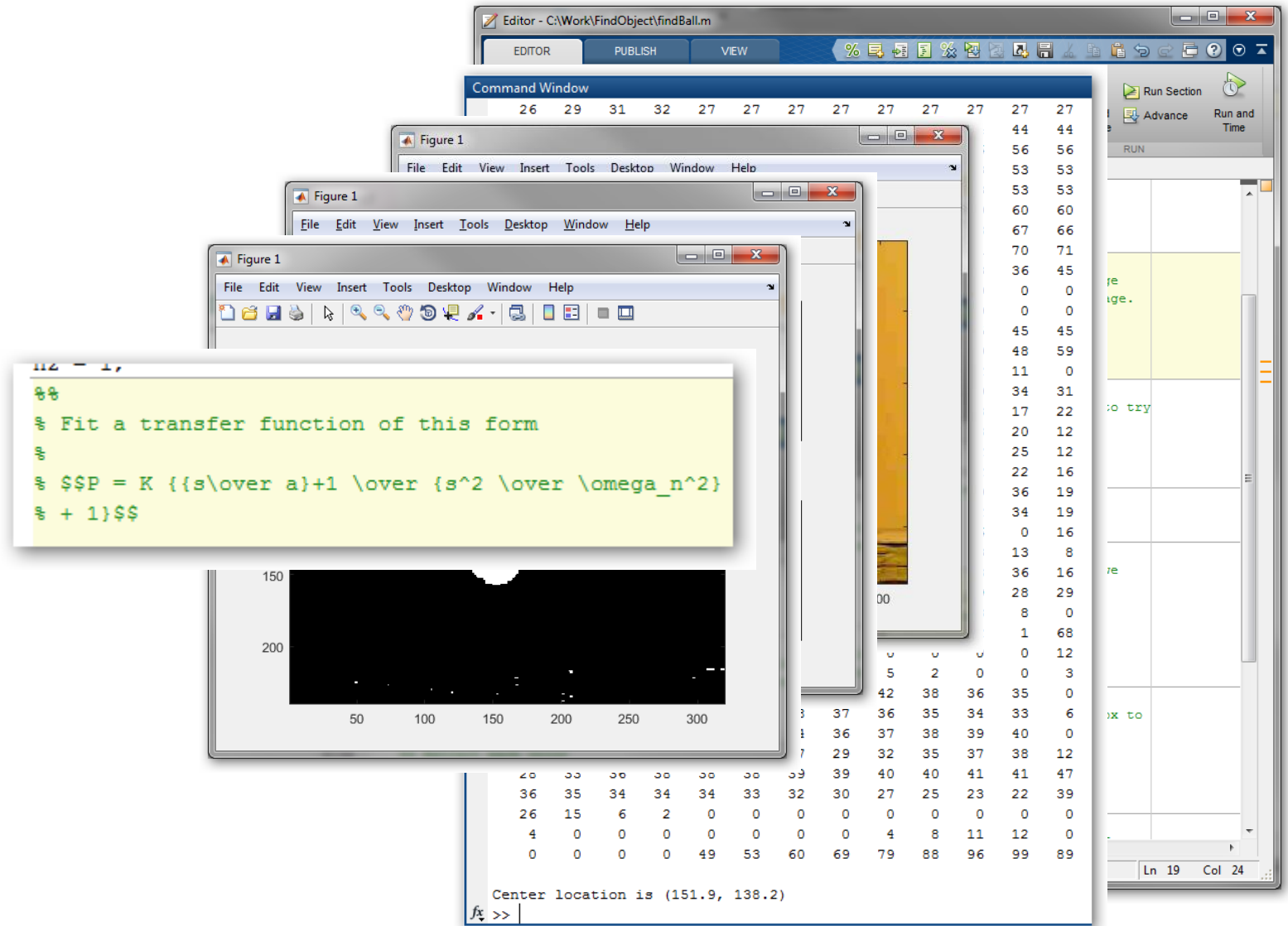


Agenda

- What is the Live Editor?
- Live Editor Demo
- Using the Live Editor
- Summary

Editing and Running MATLAB Code Today

- Plain-text editing
- Output goes to Command Window
- Multiple figure windows appear
- Equations, images, and hyperlinks only appear if published



What is the Live Editor?

The Live Editor provides a **new way to create, edit and run MATLAB code.**

- Write, edit, and run code in a single interactive environment
- Generate results and graphics in the Live Editor alongside the code that produced them
- Include LaTeX equations, images, and hyperlinks as supporting material to create an interactive narrative
- Share your narrative as a richly formatted, executable document with code and results

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SunriseSunset.mlx

Solar Declination

The other value we need is the [solar declination](#). Solar declination (δ) is the angle of the sun relative to the earth's equatorial plane.

Declination = 0° at Vernal and Autumnal Equinox Declination = 23.45° at Summer Solstice

The solar declination is 0° at the vernal and autumnal equinoxes and in the northern hemisphere rises to a maximum of 23.45° at the summer solstice. On any given day of the year (d), solar declination (δ) can be calculated from the following formula:

$$\delta = \sin^{-1} \left[\sin(23.45) \sin \left(\frac{360}{365} (d - 81) \right) \right]$$

Live Editorを使えば、英語以外の言語でも分析結果を記述できます。

```
delta = asind(sind(23.45)*sind(360*(days - 81)/365));    % Solar
clf
plot(days,delta)
axis([1 365 -30 30])
title('Solar Declination')
xlabel('Day of Year')
ylabel('Degrees')
```

Estimating Sunrise and Sunset

Minutes

Day of Year

Degrees

Day of Year

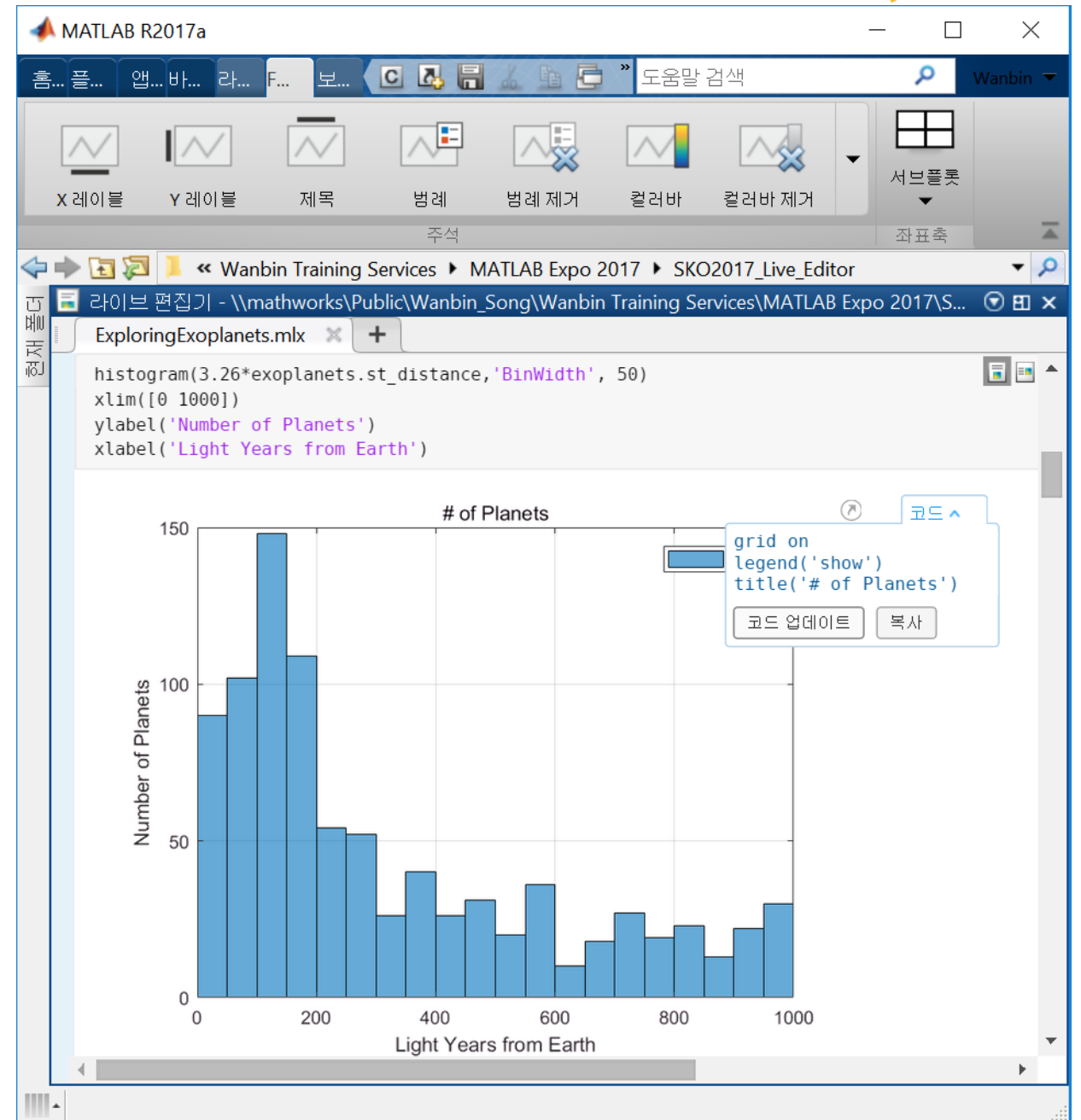
Live Editor Demo

Using the Live Editor

Accelerate Exploratory Programming

- Write, execute, and test code in a single interactive environment
- Generate results and graphics in the Live Editor alongside the code that produced them
- Find errors at the location in the file where they occur
- Suggests corrections for mistyped commands and variables
- Edit a figure interactively

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Using the Live Editor

Create an Interactive Narrative

- Add titles, headings, and formatted text
- Include LaTeX equations
- Add images, and hyperlinks as supporting material
- Save your narrative with code and results that others can use to validate and extend your results
- Convert interactive documents to HTML or PDF for publication

LiveEditorInteractiveNarrative.pdf - Adobe Acrobat

File Edit View Document Comments Forms Tools Advanced Window Help

Power Generation in Solar Cells

Overall Approach

In this example we will estimate the **power output** from a typical solar panel installation. We will use 12 noon on June 1st in Boston to illustrate how to calculate the following:

- Solar time
- Solar declination and solar elevation
- Air mass and the solar radiation reaching the earth's surface
- Radiation on a solar panel given its position, tilt, and efficiency
- Power generated in a day and over the entire year

We will use these formulas to plot solar and panel radiation for our example day, and then plot the expected panel power generation over the course of a year. We'll use two MATLAB functions created for this analysis, `solarCorrection` and `hourlyPanelRadiation`, to streamline the analysis.

Solar Time

Show output together with the code that produced it. To run a section of code, go to the **Live Editor** tab and click the **Run Section** button.

Power generation in a solar panel depends on how much solar radiation reaches the panel which in turn depends on the sun's position relative to the panel as the sun moves across the sky.

```
lambda = -71.06; % Boston longitude
phi = 42.36; % Boston latitude
UTCoff = -5; % Boston UTC offset
TZ = ['UTC' num2str(UTCoff)];
january1 = datetime(2016,1,1,'TimeZone',TZ); % January 1st
localTime = datetime(2016,6,1,12,0,0,'TimeZone',TZ) % Noon on June 1
```

```
localTime = datetime
    2016-06-01 12:00:00
```

To calculate the sun's position for a given date and time we need to use *solar time*. Twelve noon solar time is defined to be the time when the sun is highest in the sky. To calculate solar time we apply a

8.50 x 11.00 in < >

Using the Live Editor

Teach with Live Scripts

- Create lectures that combine code and results with formatted text and mathematical equations
- Include images, and links to supporting materials
- Modify and run code on the fly to answer questions or explore related topics
- Share lectures with students as interactive documents or in hardcopy format.
- Create partially completed files for individual assignments or team projects

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라이브 편집기 보기

TeachWithLiveScripts.mlx* × +

Knowing this, we can write the following expression for i :

$$i = \cos\left(\left(2k + \frac{1}{2}\right)\pi\right) + i \sin\left(\left(2k + \frac{1}{2}\right)\pi\right).$$

Taking the n th root of both sides gives

$$i^{1/n} = \left(\cos\left(\left(2k + \frac{1}{2}\right)\pi\right) + i \sin\left(\left(2k + \frac{1}{2}\right)\pi\right)\right)^{1/n}$$

and by de Moivre's theorem we get

$$i^{1/n} = \left(\cos\left(\left(2k + \frac{1}{2}\right)\pi\right) + i \sin\left(\left(2k + \frac{1}{2}\right)\pi\right)\right)^{1/n} = \cos\left(\frac{\left(2k + \frac{1}{2}\right)\pi}{n}\right) + i \sin\left(\frac{\left(2k + \frac{1}{2}\right)\pi}{n}\right).$$

Homework

Use live scripts as the basis for assignments. Give students the live script used in the lecture and have them complete exercises that test their understanding of the material.

Use the techniques described above to complete the following exercises:

Exercise 1: Write MATLAB code to calculate the 3 cube roots of i .

% MATLAB 코드를 입력해보세요

Exercise 2: Write MATLAB code to calculate the 5 fifth roots of -1 .

% MATLAB 코드를 입력해보세요

Exercise 3: Describe the mathematical approach you would use to calculate the n th roots of an arbitrary complex number. Include the equations you used in your approach.

(여기에 작성해보세요.)

Summary

- Key Takeaways
 - New form of Coding
 - Documentation
 - Visualization of Outputs
 - Still MATLAB
 - Compatible with MATLAB Script
 - Do not need to learn new language

The screenshot displays the MATLAB Live Editor interface. At the top, a window titled 'Exploring Exoplanets' shows a dark space background. Below it, another window titled 'Square Wave from Sine Waves' is open, showing a series of plots and code blocks. The code blocks contain MATLAB scripts for generating sine waves and their Fourier series approximations. A 3D surface plot is overlaid on the code, and a blue arrow points from it to a plot window titled 'The building of a square wave: Gibbs' effect'. At the bottom, a text box contains the text 'Try This: Click on the figure then select data tips and select the first bar in the chart.' and a code block for a histogram: `histogram(3.26*exoplanets.st distance, 'BinWidth', 50)`.

Summary

- Try today in our Demo booth

