Using Dynamo to Assist with a Solar Study

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Over thirty years experience working as an Architectural Technician managing production of working drawings using CAD systems specialising in automating CAD tasks from the early days of AutoCAD using LISP and later using Revit to automate the BIM process using Dynamo, Python, Microsoft C#.Net and the Revit API.
Smart buildings to optimize energy efficiency

Designing smart energy efficient buildings that react automatically according to environmental factors.

This session will be a hands-on introduction to Dynamo as a visual programming tool, it includes a bit of Python and a little Revit API. With this knowledge we will control solar panels that follow the sun, to allow designers to decide on the optimal distance, rotation and layout of the panels. We will also look at how to use parametric curtain panels and adaptive components that open and close depending on the location of the sun, this will help designers to design buildings that will react with its environment to optimize energy consumption.
Hands on Labs
Lab 1 Controlling the Sun

- Get sun direction
- Moving the sun
Lab 2 Solar Panels Follow The Sun

- Solar panels made to automatically follow the sun
- Created from 2 x point adaptive components

- SolarPanels_2021.rvt
- SolarPanel.rfa
- SolarPanel.dyn
Lab 3 Using Curtain Panels

• Using curtain panels that open and close according to the sun’s location
• Establish a vector for the sun direction
• Establish a vector for the direction of the curtain panel
• Get the angle between the two vectors
• Open the curtain panel depending on the angle

• Frame-Panel.rfa
• CurtainPanels_SolarStudy_WithLines.dyn
Lab 3 Using Curtain Panels

- CurtainPanels_SolarStudy.rvt
- CurtainPanels_SolarStudy.dyn

Flip connectors min and max for the opposite effect.
Lab 4 Using Adaptive Components

- Parametric Adaptive components open and close depending on the angle of the sun.

- AdaptiveComponents.rvt
- AdaptiveComponents.dyn
- AlBahar_Panel_2021.rfa

Al Bahar towers - Abu Dhabi
Lab 4 Using Adaptive Components

- Get all the adaptive components
- Workout their facing direction
- Compare with the direction of the sun and open or close the panel accordingly
Lab 5 Combined Model

- Combined dynamo scripts animation
- Sample model used for training purposes only
Lab 6 RevitAPI AddIn

- RevitAPI provides a comprehensive set of functionality to assist in automation.

- This sample code shows the use of the SunAndShadowSettings class of the Revit API to move the sun back and forth in time.

- This Lab provides some basic code which shows how to setup a custom tab, with a custom panel and three simple command buttons.

- Using Visual Studio as the development environment
- Microsoft .Net Framework 4.8
- .Net C# as the development language

- RevitAPI Reference:
  - www.RevitAPIDocs.com
Solar Terms

- **Azimuth** is the bearing angle from True North, measured in degrees. Azimuth angles range from 0 degrees (north) through 90 (east), 180 (south), 270 (west), and up to 360 (north again).

- **Altitude** is the vertical angle between the horizon and the sun, measured from the horizon. Altitude angles range from 0 (on the horizon) up to 90 degrees (at the zenith).

- **Summer solstice**, the longest day of the year, that occurs around June 21 and

- **Winter solstice**, the shortest day of the year, that occurs around December 21.

- **Equinox** is the time when the sun crosses the plane of the earth's equator, making night and day of approximately equal length all over the earth.

- **Spring equinox** occurs about March 21
- **Fall equinox** occurs on September 21