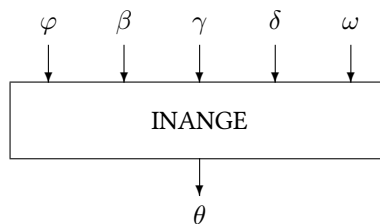


## Block INANGE

The INANGE block calculates the incidence angle of beam radiation on an arbitrarily oriented plane, when the position of the Sun is given in equator coordinates.



|                   |        |
|-------------------|--------|
| <b>Name</b>       | INANGE |
| <b>Function</b>   | em0007 |
| <b>Inputs</b>     | 5      |
| <b>Outputs</b>    | 1      |
| <b>Parameters</b> | 0      |
| <b>Strings</b>    | 0      |
| <b>Group</b>      | S      |

### Inputs

- 1 Latitude  $\varphi \in [-90^\circ, +90^\circ]$ , northern hemisphere positive
- 2 Slope  $\beta$
- 3 Azimuth angle of the surface  $\gamma$  (north =  $0^\circ$ , east =  $90^\circ$  ... west =  $270^\circ$ )
- 4 Declination of the Sun  $\delta / ^\circ$
- 5 Hour angle of the Sun  $\omega$  ( $0^\circ$  ...  $360^\circ$  west)

### Outputs

- 1 Incidence angle  $\theta / ^\circ$  between beam radiation and surface normal

### Parameters

None

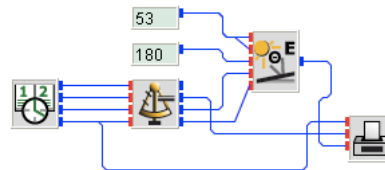
### Strings

None

**Description** The incidence angle  $\theta$  is calculated from the equation

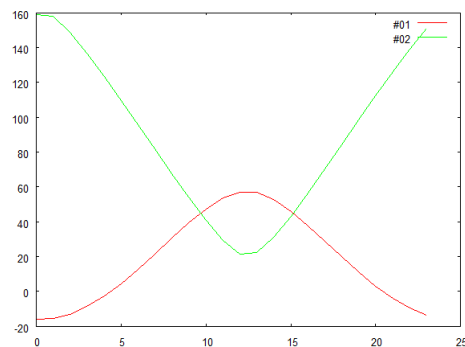
$$\begin{aligned}\cos \theta = & \sin \delta (\sin \varphi \cos \beta + \cos \varphi \sin \beta \cos \gamma) \\ & + \cos \delta \cos \omega (\cos \varphi \cos \beta - \sin \varphi \sin \beta \cos \gamma) \\ & - \cos \delta \sin \beta \sin \gamma \sin \omega\end{aligned}$$

**inange.vseit**



A **CLOCK** block runs through the 23<sup>rd</sup> of May 2010 in steps of one hour. A **SUNAE** block calculates the position of the Sun for a latitude of 53 degrees, 8 degrees east (that is close to Oldenburg, Germany).

Assuming latitude and tilt angle equal to 53 degrees with a surface facing south (azimuth 180 degrees) the **INANGE** block calculates the incidence angle using equator coordinates and the **PLOT** block displays the elevation of the Sun and the incidence angle as a function of the hour of the day.



**See also** Block **INANGH**.