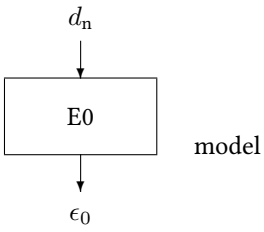
Block E0

The E0 block calculates the eccentricity correction of the Earth's orbit.





model

Name	E0
Function	em0002
Inputs	1
Outputs	1
Parameters	1
Strings	0
Group	S

Inputs

1 Day of the year d_n

Outputs

1 Eccentricity ϵ_0

Parameters

1 Approximation
- 0 Spencer
- 1 Duffie Beckman

Strings

None

Description

The path of the Earth's orbit is not exactly a circle but an ellipse with a small eccentricity and with the Sun in one of the foci. The real distance r_{se} between Sun and Earth varies between 0.983 AU $= 147.1$ Gm (perigee) and 1.017 AU $= 152.1$ Gm (apogee).

The eccentricity correction factor of the Earth's orbit defined as $\epsilon_0 = (\bar{r}_{se}/r_{se})^2$ can be approximated by

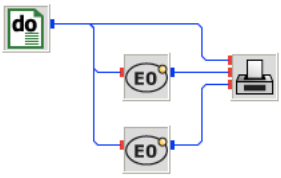
$$\epsilon_0 = 1 + 0.033 \cdot \cos(2\pi d_n/365)$$

where $d_n \in [1, 365]$ denotes the day number of the year. The Fourier series as given by Spencer

$$\begin{aligned}\epsilon_0 = {} & 1.00010 + 0.034221 \cdot \cos d + 0.001280 \cdot \sin d \\ & + \ 0.000719 \cdot \cos 2d + 0.000077 \cdot \sin 2d\end{aligned}$$

is more accurate.

e0.vseit



A DO block counts through the days of a year from 1 to 365. The two E0 blocks calculate the eccentricity after Spencer (upper block) and Duffie and Beckman (lower block).

The PLOT block shows the result.

