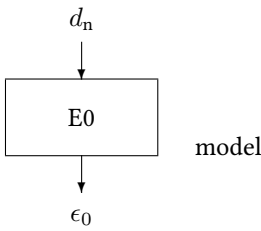


Block E0

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



|            |        |
|------------|--------|
| 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  $\epsilon_0$

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  $0.983 \text{ AU} = 147.1 \text{ Gm}$  (perigee) and  $1.017 \text{ AU} = 152.1 \text{ Gm}$  (apogee).

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

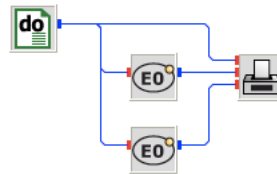
$$\epsilon_0 = 1 + 0.033 \cdot \cos(2\pi d_n/365)$$

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.

