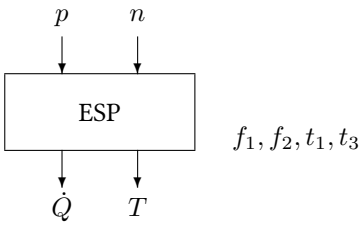
Block ESP

The ESP block calculates the flowrate and the torque of the excentric screw pump as a function of the delivery height and the rotational speed.





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Inputs

1 Delivery height H / m
2 Rotational speed n / s^{-1}

Outputs

1 Flowrate $\dot{Q}$ / $\mathrm{m^3\,h^{-1}}$
2 Required torque T / N m

Parameters

1 Displacement volume V_0 / $\mathrm{m^3\,s\,h^{-1}}$
2 Height parameter c / $\mathrm{m^{-2}}$
3 Hydraulic parameter c_0 / N
4 Friction loss T_1 / N m
5 Turbulence c_1 / $\mathrm{N\,m\,s^2}$
6 Transition coefficient c_2 / N m
7 Transition exponent c_3 / s

Strings

None

Description

The flowrate of a screw pump (also known as progressive cavity pump or PCP) is modeled by

$$\dot{Q} = V_0 n - cH^2$$

where V_0 is the geometric volume of displacement, n the rotational speed per second, H the delivery height in meters. c is a free fit parameter.

The torque is calculated by the equation

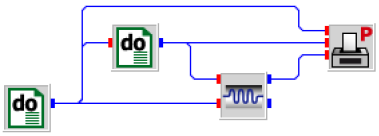
$$T = c_0 H + T_1 + c_1 n^2 + c_2 \exp(-c_3 n)$$

The first term corresponds to the hydraulic delivery rate, friction losses are assumed to cause a constant torque T_1.

$c_2 n^2$ represents the torque caused by turbulent flow in the inlet and outlet as well as within the working area in the cavities.

The term $c_3 \exp(-c_4 n)$ considers the torque by occasion of a transition from one form of friction to another (static friction, sliding friction, friction of laminar and turbulent flows).

esp.vseit



The delivery height of a screw pump is varied between zero and 100 meters by a DO block. The rotational speed of the pump is varied between 10 and 100 per second in steps of 10 by a second DO block.

The delivery height of the pump is plotted as a function of the flowrate by a PLOTP block.

