Sage Model Notes

AlphaEngineFlywheel.scfn

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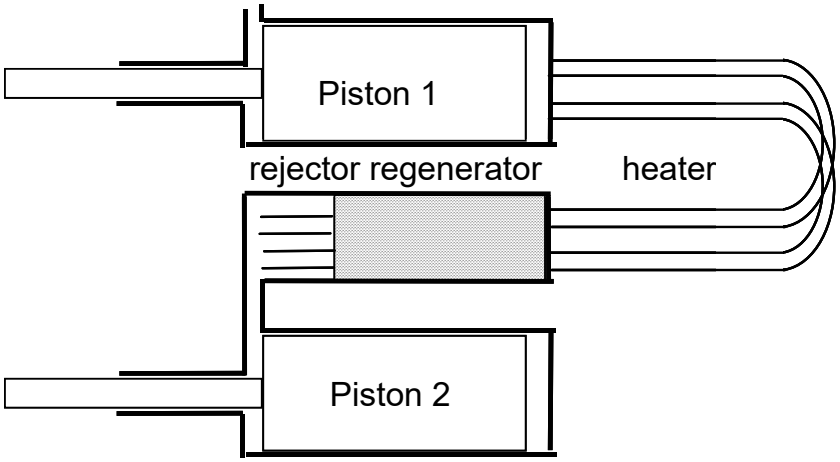
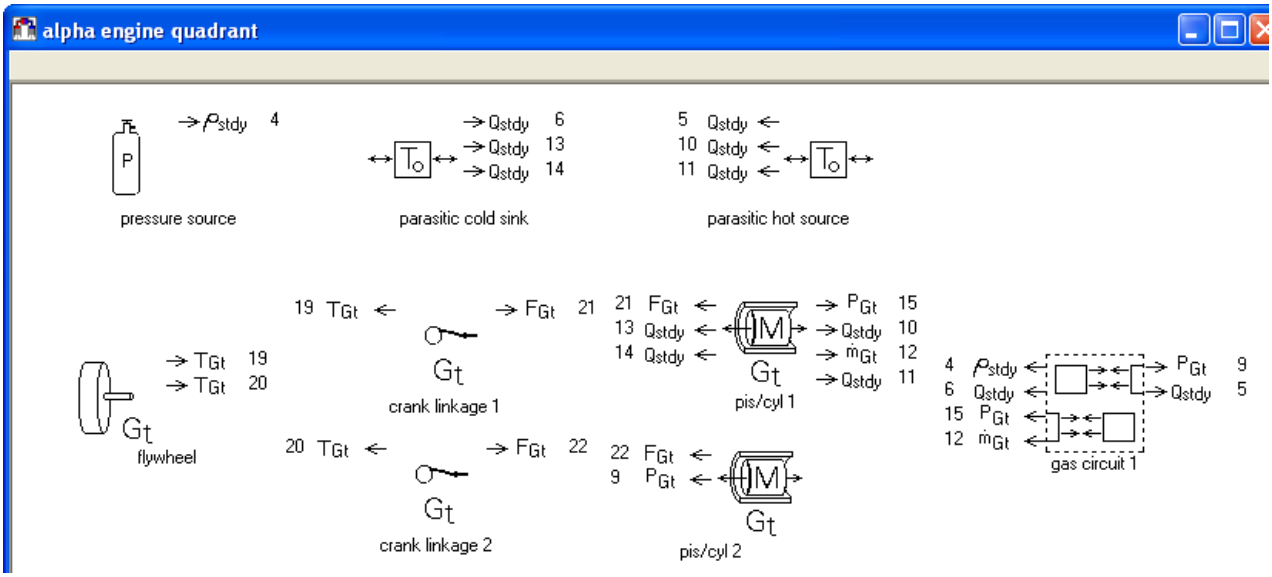
This model is identical to the AlphaEngine model (*see* AlphaEngine.pdf) except a flywheel component connects to t*wo simple-crank kinematic linkage components* driving *two reciprocating mass components* in place two simple-crank piston components in the previous model. This approach adds the realism of a rotating flywheel to the model with fluctuations in its rotational angular velocity as a result of finite rotational moment of inertia and the applied torque. A schematic of the gas-circuit is the same as before and looks like this:



The Sage model looks like this at the top level:



These notes discuss only the new components compared to the earlier model AlphaEngine.scfn. The earlier model is documented in AlphaEngine.pdf.

Component *pis/cyl 1* represents the hot piston dome of one piston (including the appendix gap between the dome and cylinder wall).

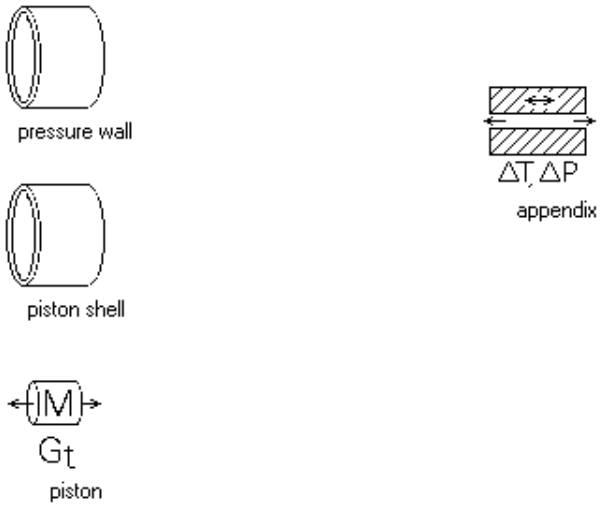
Component *pis/cyl 2* represents the cold face of another piston without any appendix gap.

Components *crank linkage 1* and *crank linkage 2* model the kinematics that convert rotary motions to reciprocating motions. They are connected at one end to a common *flywheel* which models rotational angular momentum. The torque connections lock together the rotation of the flywheel and two linkages. They are connected at the other end to reciprocating masses within *pis/cyl 1* and *pis/cyl 2* which model linear momentum. The force connections lock together the reciprocating motions of the reciprocating masses and linkages The phasing of *crank linkage 2* is advanced 90 degrees relative to *crank linkage 1* and that is what makes this a model of a 4-piston alpha engine. If it were advanced by 120 degrees the model would represent a 3-piston alpha engine, and so on.

In this model the pressure forces acting on the two pistons (connections labeled P_{Gt}) ultimately drive the flywheel which acts as a constant torque load that takes up any torque variations by accelerating or decelerating its angular rotation as a function of time.

Pis/Cyl 1

The *pis/cyl 1* component contains the same components as the *pis/cyl 2* component with the addition of an appendix gap component:



The *appendix* models the annular gas gap between the piston dome and cylinder wall, including the combined conduction of the two walls and the shuttle heat transfer mechanism produced by the thermal interaction between them as they move relative to each other. One end of the appendix gap connects to (gas flows to) the expansion space within gas *circuit 1* and the other is closed, as if there is a perfect piston seal. The conductive surface within the *appendix* (not shown) gets wall thickness and material information from the built-in *pressure wall* and *piston shell* components in order to implement a combined wall conduction model.

The *piston* models the reciprocating mass of the piston (including any effective reciprocating mass of the attached linkage) and also the displacement (frontal area attachment) produced by the piston dome.

Bottom-Line Outputs

A number of special user-defined outputs keep track of bottom-line PV power and heat flows:

Root Level	
Wpv	Net PV power delivered to pistons
Qin	Heat input to heater + parasitic source
Qrej	Heat rejected to cooler + parasitic sink
Eff	Indicated efficiency
Parasitic Hot Source	
QparaSource	Heat to parasitics
Parasitic Cold Sink	
QparaSink	Heat to parasitics
Cooler Tubes	
Qcooler1	Heat to gas
Heater Tubes	
Qheater1	Heat to gas
Pis/cyl 1	
Wpis1	PV power to piston
Pis/cyl 2	
Wpis2	PV power to piston