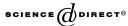
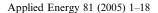


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Energy-saving hybrid vehicle using a pneumatic-power system

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Abstract

The power system enables the internal-combustion engine to function at its optimal operating point without a complicated controller. The waste heat from the internal-combustion engine can be recycled and stored, then converted into mechanical energy, thereby raising the overall thermal efficiency of this system. A computer-aided simulation program is used to simulate the overall dynamic features of this hybrid pneumatic-power system, so as to demonstrate its desirable features. The overall efficiency of this system is expected to increase by about 20%.

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Keywords: Hybrid vehicle; Pneumatic-power system; Flow work

1. Introduction

Today, the R&D activities focus on Zero-Pollution Vehicles and green engines, of which the electronic vehicle (EV) serves as a representative of Zero-Pollution Vehicles and the hybrid electronic-vehicle (HEV) or fuel cell as a representative using a

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Nomenclature

 $\eta_{\rm mixer}$

```
inlet enthalpy
h_1
         outlet enthalpy
h_2
         inlet enthalpy at compressor
h_{\rm a}
         outlet enthalpy at compressor
h_{\rm c}
h_{\rm e}
         outlet enthalpy at internal-combustion engine
         enthalpy at inlet of pneumatic motor
h_{\rm m}
         outlet enthalpy at one-way pressure valve
h_{\Omega}
         outlet enthalpy at throttle
h_{t}
h'
         enthalpy at outlet of pneumatic motor
         enthalpy at pressure release for mixer chamber
h'_{\epsilon}
m
         air-mass flow rate
         air-mass flow rate at compressor inlet
\dot{m}_a
         air-mass flow rate at compressor outlet
\dot{m}_{\rm c}
         air-mass flow rate at internal-combustion engine's outlet
\dot{m}_{\rm e}
\dot{m}_{
m m}
         air-mass flow rate at pneumatic-motor's inlet
         air-mass flow rate through one-way pressure valve
\dot{m}_{\rm o}
\dot{m}_{^{\dagger}}
         air-mass flow rate through throttle's outlet
         air-mass flow rate through pneumatic-motor's outlet
\dot{m}'_a
         air-mass flow rate at pressure release for mixer chamber
\dot{m}'_{\scriptscriptstyle P}
         ambient pressure
P_0
         energy loss
q_{\rm out}
         ambient entropy
s_0
         inlet entropy
s_1
         entropy of storage tank
So
         ambient temperature
T_0
         ambient internal-energy
u_0
         internal energy of storage tank
u_2
         ambient specific-volume
v_0
         specific volume of storage tank
W_{\text{Torque}} output work of internal-combustion engine
\dot{W}_{\rm comp,in} input power of compressor
\dot{W}_{\rm comp,in,real} power loss of compressor
         input work
W_{\text{motor,out,real}} real output-power of pneumatic motor
\dot{W}_{\rm motor, out} output power of pneumatic motor
         output work
W_{\rm net}
\Delta Ke
         kinetic energy
ΔPe
         potential energy
\eta_{\rm airmotor} thermal efficiency of pneumatic motor
         mechanical efficiency of compressor
\eta_{\rm comp}
\eta_{\text{compressor}} thermal efficiency of compressor
         recycling thermal efficiency of the exhaust heat
```

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