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FALSIFICATIONS OF POISSON ADIABATE, HUGONIO ADIABATE, LAPLACE SOUND SPEEDS. MODERNIZATION OF FOUNDATIONS OF THERMODYNAMICS

Abstract. The inequality of the universal gas constant of the difference in the heat capacity of a gas at constant pressure with the heat capacity of a gas at a constant volume is proved. The falsifications of using the heat capacity of a gas at constant pressure, false enthalpy, Poisson adiabat, Laplace sound speed, Hugoniot adiabat, based on the use of the false equality of the universal gas constant difference in the heat capacity of a gas at constant pressure with the heat capacity of a gas at a constant volume, have been established. The dependence of pressure on temperature in an adiabatic gas with heat capacity at constant volume has been established. On the basis of the heat capacity of a gas at a constant volume, new formulas are derived: the adiabats of an ideal gas, the speed of sound, and the adiabats on a shock wave. The variability of pressure in the field of gravity is proved and it is indicated that the use of the specific coefficient of ideal gas at constant pressure in gas-dynamic formulas is pointless. It is shown that the false "basic formula of thermodynamics" implies the falseness of the equation with the specific heat capacity at constant pressure. New formulas are given for the adiabat of an ideal gas, adiabat on a shock wave, and the speed of sound, which, in principle, do not contain the coefficient of the specific heat capacity of a gas at constant pressure. It is shown that the well-known equation of heat conductivity with the gas heat capacity coefficient at constant pressure contradicts the basic energy balance equation with the gas heat capacity coefficient at constant volume.

Key words: speed of sound, heat capacity, adiabat, isobaric, isothermal.

1. Falsifications of the difference in heat capacities $C_p - C_v = R$

The difference in heat capacities of gas $C_p - C_v = R$ is considered the basic formula of thermodynamics and is derived from the first law of thermodynamics [2, 3]:

$$d'Q = dU_{\text{км}} + pdV_{\text{км}} \tag{1}$$

In (1) $d'Q$ the amount of heat, $dU_{\text{км}}$ the differential of the internal energy of a kilomole of gas $U_{\text{км}} = C_v T$, accord ing to the equation of state of Clapeyron $V_{\text{км}} = RT/p$:

$$d'Q = C_v dT + pRd\frac{T}{p} \tag{2}$$

Only by the hypothesis of constant pressure, putting in (2) $d'Q = C_p dT$, we get formula $C_p - C_v = R$, where C_p is the heat capacity of gas at constant pressure $p = const$. The heat capacity at a constant volume is $C_v = \frac{iR}{2}$, where $i = n_{\text{translat}} + n_{\text{rotat}} + 2n_{\text{vibrat}}$ is the sum of the translational, rotational and doubled number of vibrational degrees of freedom of the molecule, the universal gas constant $R = 8{,}31 \cdot 10^3 \ \frac{joule}{\deg \cdot kilomole}$.

Theorem 1. *In an adiabatic gas, pressure is a variable and depends on temperature* $\frac{p}{p_0} = (\frac{T}{T_0})^{\frac{i}{2}+1}$. *The constant pressure hypothesis in adiabatic and non-isothermal gas leads to false equality* $C_v = -R$, *because* $C_v = \frac{iR}{2}$.

Evidence. Let the pressure in adiabatic gas $d'Q = 0$ be constant:

$$0 = C_v dT + pRd\frac{T}{p} \tag{3}$$

In nonisometric gas $T \neq const,\ dT \neq 0$ in (3), the pressure decreases:

$$0 = C_v dT + RdT,\ C_v + R = 0 \tag{4}$$

The second equality of (4) implies the negativity of the specific heat $C_v = -R$, which contradicts formula $C_v = \frac{iR}{2} > 0$. The heat capacity of gas $C_v = \frac{iR}{2}$ in equation (3) establishes the dependence of pressure on temperature:

$$0 = \frac{i}{2}RdT + pd\frac{RT}{p},\ (\frac{i}{2}+1)\frac{dT}{T} = \frac{dp}{p},\ \frac{p}{p_0} = (\frac{T}{T_0})^{\frac{i}{2}+1} \tag{5}$$

the Theorem is proved.

According to theorem 1, the constancy of pressure in adiabatic and non-isothermal gas led to a false equality of $C_v = -R$. in Exactly the same way in [2,3] et al .the hypothesis of pressure constancy in the 1st law of thermodynamics (2) was applied to derive the false formula $C_p - C_v = R$.

Theorem 2. *In an isothermal and Isobaric gas, the difference in heat capacity is not equal to the universal gas constant* $C_p - C_v \neq R$.

Evidence. Let a kilomole of gas be supplied with heat at a constant step $d'Q = C_p dT$:

$$C_p dT = C_v dT + pRd\frac{T}{p}$$

After reducing the pressure $p = const$ is obtained

$$C_p dT = C_v dT + RdT,\quad (C_p - C_v - R)dT = 0 \tag{6}$$

Equality to zero in (6) will take place if one of the cofactors is equal to zero. By the condition of theorem $dT = 0$ in an isothermal gas, equality to zero in (6) holds, so the second factor is not equal to zero:

$$(C_p - C_v - R) \neq 0, \tag{7}$$

The conclusion follows from inequality (7): in an isothermal and Isobaric gas, the difference in heat capacity is not equal to the universal gas constant $C_p - C_v \neq R$. *The theorem is proved.*

Theorem 3. *The difference between an arbitrary heat capacity gas heat capacity of gas at constant volume is not equal to universal gas constant:* $C - C_v \neq R, \forall C$.

Evidence. Let the gas be supplied with heat $d'Q = CdT$: $CdT = C_v dT + pRd\dfrac{T}{p}$.

Transform the differential of the quotient in the right part: $CdT = C_v dT + pR\dfrac{pdT - Tdp}{p^2}$.

After abbreviations and bringing similar results

$$(C - C_v - R)dT = -RT\frac{dp}{p} \tag{8}$$

From (8) follows the inequality to zero $C - C_v - R \neq 0$ for all heat capacities of the gas. The hy pothesis of constancy of pressure in the right part (8) $dp = 0,\ \ p = const$ means equality to zero $dT = 0$ in the left part, that is, the isothermicity of the gas and the validity of the inequality $C - C_v \neq R, \forall C$. *The theorem is proved.*

2.Adiabat of ideal gas with heat capacity $C_v = \dfrac{iR}{2}$

Let heat $d'Q = CdT$ be applied to the kilomole of gas. The 1-st law of thermodynamics (2) is transformed based on the equation of state of Clapeyron $pV = mRT / \mu,$ written for volume V, which contains a gas mass of m with a density of $\rho = m / V$. Equation of state of Clapeyron by equalities $V_{\text{км}} = \dfrac{\mu}{m}V$ takes the form of $p = \dfrac{\rho RT}{\mu}$, $\mu = const$ -the mass of a kilomol. Equation (1) uses differentials $d'Q = CdT$, $dU_{\text{км}} = C_v dT$.

Then the necessary transformations are performed:

$$(C - C_v)dT = pdV_{\text{км}},\quad (C - C_v)dT = pd(\frac{\mu}{m}V),\ \ \rho = \frac{m}{V},$$

$$\frac{(C - C_v)}{R}\frac{dp}{p} = (\frac{(C - C_v)}{R} - 1)\frac{d\rho}{\rho},\ \frac{dp}{p} = (1 - \frac{R}{C - C_v})\frac{d\rho}{\rho}$$

From the last equality follows the barotropy of the gas at $C \neq C_v$:

$$\frac{p}{p_0} = (\frac{\rho}{\rho_0})^{1 - \frac{R}{C - C_v}} \tag{9}$$

Apply the formula (9) in adiabatic gas $d'Q = 0,\ C = 0,\ C_v = \dfrac{i}{2}R,\ \dfrac{R}{C_v} = \dfrac{2}{i}$:

$$\frac{p}{p_0} = (\frac{\rho}{\rho_0})^{1 + \frac{R}{C_v}},\quad \frac{p}{p_0} = (\frac{\rho}{\rho_0})^{1 + \frac{2}{i}},\ i = n_{\text{translat}} + n_{\text{rotat}} + 2n_{\text{vibrat}} \tag{10}$$

The Poisson adiabate $\dfrac{p}{p_0} = (\dfrac{\rho}{\rho_0})^{\frac{c_p}{c_v}}$ is derived in [2,3] by a false formula $c_p - c_v = \dfrac{R}{\mu}$,

adiabata Jakupov (10) is based on $C_v = \dfrac{iR}{2}$.

3. The speed of sound. Falsifications of Poisson, Laplace, Hugonio.
Alibata on the shock wave

The speed of sound is calculated using the Jakupov $\frac{p}{p_0}=(\frac{\rho}{\rho_0})^{1+\frac{2}{i}}$ adiabat : $a=\sqrt{\frac{\partial p}{\partial \rho}}$,

$a=\sqrt{(1+\frac{2}{i})\frac{p}{\rho}}$, $a=\sqrt{(1+\frac{2}{i})\frac{R}{\mu}T}$, $i=n_{\text{translat}}+n_{\text{rotat}}+2n_{\text{vibrat}}$

Falsifications [2] of Poisson's adiabata $\frac{p}{p_0}=(\frac{\rho}{\rho_0})^{\frac{c_p}{c_v}}$ and the speed of sound Laplace's $a=\sqrt{\frac{c_p}{c_v}RT}$ are consequences of the false equality $C_p-C_v=R$.

Adibata Hugonio [2] on a shock wave is obtained by repeated using a false formula $C_p-C_v=R$:

$$\frac{p_2}{p_1}=\frac{(k+1)\rho_2/\rho_1-(k-1)}{(k+1)-(k-1)\rho_2/\rho_1}, \tag{11}$$

$k=\frac{c_p}{c_v}$, specific heat capacity ratio $c_p=\frac{C_p}{\mu}, c_v=\frac{C_v}{\mu}$, $c_p-c_v=\frac{R}{\mu}$.

The Hugonio relations [2] relate the parameters of a gas on a shock wave

$$\rho_2 V_2^2+p_2=\rho_1 V_1^2+p_1,\ \ \rho_2 V_2=\rho_1 V_1\ , \tag{12}$$

$$c_v T_2+\frac{V_2^2}{2}+\frac{p_2}{\rho_2}=c_v T_1+\frac{V_1^2}{2}+\frac{p_1}{\rho_1} \tag{13}$$

In gas dynamics [2] in order to apply the specific heat capacity at constant pressure, the enthalpy $h=c_pT$ is widely used , which is converted to the form of a false formula $c_p-c_v=\frac{R}{\mu}$:

$$h=c_pT=\frac{c_p}{\frac{R}{\mu}}\frac{R}{\mu}T=\frac{c_p}{c_p-c_v}\frac{R}{\mu}T \tag{14}$$

Because of the false formula $c_p-c_v=\frac{R}{\mu}$ is obtained counterfeit enthalpy

$$h=\frac{c_p}{c_p-c_v}\frac{R}{\mu}T=\frac{c_p}{c_p-c_v}\frac{p}{\rho}=\frac{k}{k-1}\frac{p}{\rho},\ \ k=\frac{c_p}{c_v},\ \ h=\frac{k}{k-1}\frac{p}{\rho}$$

Further, according to the Clapeyron equation $p=\frac{\rho RT}{\mu}$ and formula $c_p-c_v=\frac{R}{\mu}=R_*$ fake made conversion [2]:

$$c_vT=\frac{c_v}{R_*}R_*T=\frac{c_v}{c_p-c_v}\frac{R}{\mu}T=\frac{c_v/c_v}{c_p/c_v-c_v/c_v}\frac{p}{\rho}=\frac{1}{k-1}\frac{p}{\rho} \tag{15}$$

The correct ratio shows that Hugoniot at the shock wave (13) is reduced to a fake form:

$$\frac{k}{k-1}\frac{p_2}{\rho_2}+\frac{V_2^2}{2}=\frac{k}{k-1}\frac{p_1}{\rho_1}+\frac{V_1^2}{2} \tag{16}$$

Conservation of the total momentum on the shock wave (12) is to mind

$$p_1-p_2=\rho_2V_2^2-\rho_1V_1^2=\rho_1V_1\,(V_2-V_1\,)$$

Both parts of this expression are multiplied by the ratio

$$\frac{V_2+V_1}{\rho_1V_1}=\frac{V_2}{\rho_1V_1}+\frac{V_1}{\rho_1V_1}=\frac{V_2}{\rho_2V_2}+\frac{V_1}{\rho_1V_1}=\frac{1}{\rho_2}+\frac{1}{\rho_1},$$

and from the left to $\frac{1}{\rho_2}+\frac{1}{\rho_1}$, and from the right to $\frac{V_2+V_1}{\rho_1V_1}$.

The result is

$$(p_1-p_2)(\frac{1}{\rho_2}+\frac{1}{\rho_1})=V_2^2-V_1^2 \tag{17}$$

Multiplying (13) by 2, we find

$$V_2^2-V_1^2=2(\frac{p_1}{\rho_1}-\frac{p_2}{\rho_2})+2c_v(T_1-T_2) \tag{18}$$

According to equation of state $T=\frac{\mu}{R}\frac{p}{\rho}$, expression (18) takes the form

$$V_2^2-V_1^2=2(1+\frac{c_v\mu}{R})(\frac{p_1}{\rho_1}-\frac{p_2}{\rho_2}) \tag{19}$$

Substituting (17) in the right part (19), we find

$$(p_1-p_2)(\frac{1}{\rho_2}+\frac{1}{\rho_1})=2(1+\frac{c_v\mu}{R})(\frac{p_1}{\rho_1}-\frac{p_2}{\rho_2}) \tag{20}$$

Multiplying both parts (20) by ρ_2/p_1, we get the shock adiabata

$$\frac{p_2}{p_1}=\frac{2(1+\frac{c_v\mu}{R})\frac{\rho_2}{\rho_1}-(1+\frac{\rho_2}{\rho_1})}{2(1+\frac{c_v\mu}{R})-(1+\frac{\rho_2}{\rho_1})}=\frac{(1+2\frac{c_v\mu}{R})\frac{\rho_2}{\rho_1}-1}{(1+2\frac{c_v\mu}{R})-\frac{\rho_2}{\rho_1}} \tag{21}$$

Here the ratio is $\frac{c_v\mu}{R}=\frac{C_v}{R}=\frac{iR}{2}/R=\frac{i}{2}$, so the adiabat on the shock wave will be like this:

$$\frac{p_2}{p_1}=\frac{(1+i)\frac{\rho_2}{\rho_1}-1}{(1+i)-\frac{\rho_2}{\rho_1}},\qquad i=n_{\text{translat}}+n_{\text{rotat}}+2n_{\text{vibrat}} \tag{22}$$

4. Justification of pressure variability

The false formula of thermodynamics $C_p - C_v = R$ is a direct consequence of the first law of thermodynamics, in which the gas pressure is considered constant $p = const$. We prove the variability of pressure in statics and in gas dynamics. Theorem 1 proved the non-physical constancy of pressure in an adiabatic gas.

Static $\mathbf{v} = \mathbf{0}$. The coordinate system of Oxyz will be connected to the earth's surface. The ORT of the $\mathbf{k}$ -axis Oz is parallel and opposite to the $\mathbf{g}$ -axis acceleration of gravity:

$$\mathbf{k} \uparrow\downarrow \mathbf{g}, \ \mathbf{g} = 0\mathbf{i} + 0\mathbf{j} - g\mathbf{k}, \ g = 9{,}81\frac{m}{c^2}.$$

Consider a stationary gas $\mathbf{v} \equiv \mathbf{0}$ in volume $\Delta V = (z_2 - z_1)S$, where S the area of the cylinder base, $z_2 - z_1$ – the height of the cylinder, equal to the distance between parallel planes $z_1 = const, \ z_2 = const, \ z_1 < z_2$. Denote $\boldsymbol{n_1} = -\boldsymbol{k}$ the external normal of the surface $z_1 = const$, $\mathbf{n}_2 = \mathbf{k}$, the external normal of the surface $z_2 = const$. In an ideal gas, the Euler stress is $\mathbf{p} = -p\mathbf{n}$, p is the pressure in the gas S, located in the plane $z_1 = const$, the force $\mathbf{f_1} = -p_1\mathbf{n}_1 S$, S in a plane $z_2 = const$ the force $\mathbf{f}_2 = -p_2\mathbf{n}_2 S$, the whole mass of gas in the cylinder is the force of gravity $m\mathbf{g}, \ \mathbf{g} = -g\mathbf{k}$, the mass of gas equal to $m = \rho\Delta V$. According to Newton's second law we have the equation

$$m\frac{d\mathbf{v}}{dt} = \mathbf{f}_1 + \mathbf{f}_2 + m\mathbf{g} \tag{23}$$

In statics $\mathbf{v} = \mathbf{0}, \frac{d\mathbf{v}}{dt} = 0$, Newton's 2 law (23) takes the form

$$0 = \mathbf{f}_1 + \mathbf{f}_2 + m\mathbf{g}, \ -p_1 S\mathbf{n}_1 - p_2 S\mathbf{n}_2 + \rho(z_2 - z_1)S\mathbf{g} = 0 \tag{24}$$

In (24), we use the ORT equalities $\mathbf{n}_1 = (-\mathbf{k}), \ \mathbf{n}_2 = \mathbf{k}, \ \mathbf{g} = -g\mathbf{k}$:

$$-p_1 S(-\mathbf{k}) - p_2 S\mathbf{k} + \rho(z_2 - z_1)S(-g\mathbf{k}) = 0, \ p_1 - p_2 - \rho(z_2 - z_1)g = 0,$$

$$p_1 - p_2 = \rho(z_2 - z_1)g, \ \frac{p_2 - p_1}{z_2 - z_1} = -\rho g, \ \lim_{z_2 - z_1 \to 0}\frac{p_2 - p_1}{z_2 - z_1} = -\rho g$$

In the limit, the equation is obtained $\frac{dp}{dz} = -\rho g$, whose integral for an incompressible $\rho g \neq 0$, liquid confirms pressure variability $p \neq const$. In a compressible gas $\rho = \frac{\mu}{R}\frac{p}{T}$, the integral of equation is called the barometric formula $p = p_0 e^{-\frac{\mu g}{RT}(z - z_0)}$ [3], here also $p \neq const$.

Dynamics $\mathbf{v} \neq \mathbf{0}$. On the physics of Euler's equations of an ideal gas

$$\nabla p = \rho\mathbf{g} - \rho\frac{d\mathbf{v}}{dt}, \ \frac{\partial\rho}{\partial t} + \nabla\cdot\rho\mathbf{v} = 0, \ \rho c_v\frac{dT}{dt} = -p\nabla\cdot\mathbf{v}$$

the pressure cannot be constant: $\nabla p \neq 0, \ p \neq const$.

Note. For fake connection $C_p - C_v = R$, fake heat capacity at constant pressure is calculated

$$C_p = R + C_v = R + \frac{i}{2}R = (1 + \frac{i}{2})R$$

Thus, in both static and dynamic gas $p \neq const$, the pressure cannot be constant in the field of gravitational force, for example, under Earth conditions. Therefore, the definition of heat capacity C_p and specific heat of gas $c_p = \frac{C_p}{\mu}$ at constant pressure lose their physical meaning. Loses the physical meaning of the heat function of enthalpy $h = c_p T$.

5. Paradoxes of the equation of thermal conductivity with the coefficient of heat capacity at constant pressure

The thermal conductivity equation is derived from the law of conservation of energy with a coefficient of heat capacity at a constant volume [2]:

$$\rho c_v \frac{dT}{dt} = div\left(\lambda gradT\right) + \mu \sum_{i=1}^{3}\sum_{j=1}^{3}\left(\frac{\partial v_i}{\partial x_j}\right)^2 - p div\mathbf{v}$$

In [4], a false equation of thermal conductivity with a coefficient of heat capacity at constant pressure is given:

$$\rho c_p \frac{dT}{dt} - \frac{dp}{dt} = \nabla \cdot (\lambda \nabla T) + \frac{\mu}{2} \sum_{i=1}^{3}\sum_{j=1}^{3}\left(\frac{\partial v_i}{\partial x_j} + \frac{\partial v_j}{\partial x_i}\right)^2 - \frac{2}{3}\mu(\nabla \cdot \mathbf{v})^2$$

The falsity consists in applying the Stokes stress tensor, formula $C_p - C_v = R$, as indicated by the specific heat capacity coefficient at constant pressure c_p , which is located on the left side of the equation. Similarly the thermal conductivity equation of an ideal gas is derived with a specific coefficient of heat capacity at a constant volume of c_v :

$$\rho c_v \frac{dT}{dt} = -p\nabla \cdot \mathbf{v} \tag{25}$$

In [2,4] is replaced in the left part (25) by a false formula $c_p - c_v = \frac{R}{\mu}$ using the Clapeyron equation of state:

$$c_v T = (c_p - \frac{R}{\mu})T = c_p T - \frac{RT}{\mu} = c_p T - \frac{p}{\rho}$$

As a result, equation (25) is converted to the form

$$\rho c_p \frac{dT}{dt} - \frac{dp}{dt} + \frac{p}{\rho}\frac{d\rho}{dt} = -p\nabla \cdot \mathbf{v} \tag{26}$$

In (26), the continuity equation $d\rho / dt + \rho\nabla \cdot \mathbf{v} = 0$. Gives a false equation with a heat capacity at constant pressure

$$\rho c_p \frac{dT}{dt} - \frac{dp}{dt} = 0 \tag{27}$$

By definition, the specific coefficient of heat capacity c_p takes place at a constant pressure $p = \frac{\rho RT}{\mu} = const$. At constant pressure, the false equation (27) implies equality to zero:

$$\rho c_p \frac{dT}{dt} = 0, \ \frac{dT}{dt} = 0,$$

which contradicts the original equation (31) of the dynamic gas $\mathbf{v} \neq \mathbf{0}$:

$$\rho c_v \frac{dT}{dt} = -p\nabla \cdot \mathbf{v} \neq 0, \ \frac{d\rho}{dt} = -\rho\nabla \cdot \mathbf{v}, \ \rho c_v \frac{dT}{dt} = \frac{p}{\rho}\frac{d\rho}{dt} \neq 0$$

According to equation (25), there is an inequality to zero $\frac{dT}{dt} \neq 0$. It turns out to be absurd, which confirms the falsity of the "basic formula of thermodynamics" $C_p - C_v = R$, $c_p - c_v = \frac{R}{\mu}$. Hence, $C_p - C_v \neq R.$

6. False Poisson adiabate of ideal gas

The Poisson adiabate [3] is derived from the false equation (27). The reduction of dt in equation (27) gives a conne ction of $\frac{dp}{\rho} = c_p dT$, the Clapeyron equation is Applied, the false formula $c_p - c_v = \frac{R}{\mu}$ is used again, and the trans formations are made:

$$\frac{dp}{\rho} = c_p dT = \frac{c_p \mu}{R} d\left(\frac{RT}{\mu}\right) = \frac{c_p \mu}{R} d\left(\frac{p}{\rho}\right) = \frac{c_p}{c_p - c_v}\frac{\rho dp - p d\rho}{\rho^2},$$

$$(c_p - c_v)dp = c_p\left(dp - \frac{p}{\rho}d\rho\right), \ \frac{dp}{p} = \frac{c_p}{c_v}\frac{d\rho}{\rho}, \ d\ln p = d\ln \rho^{\frac{c_p}{c_v}}$$

From the last equality we get the Poisson adiabat $\frac{p}{p_0} = \left(\frac{\rho}{\rho_0}\right)^{\frac{c_p}{c_v}}$ with a false degree indicator due to a coefficient of c_p.

Summary

Proved: falsity of the capacity of gas c_p, falsity of the "basic formula of thermodynamics" $C_p - C_v = R,$ falsity of the of the Poisson adiabat $\frac{p}{p_0} = \left(\frac{\rho}{\rho_0}\right)^{\frac{c_p}{c_v}}$, falsity of the of the speed of sound Laplace $a = \sqrt{\frac{c_p}{c_v}RT}$, falsity of the adiabat Hugonio $\frac{p_2}{p_1} = \frac{\left(1+\frac{c_p}{c_v}\right)\frac{\rho_2}{\rho_1} - \left(\frac{c_p}{c_v}-1\right)}{\left(1+\frac{c_p}{c_v}\right) - \left(\frac{c_p}{c_v}-1\right)\frac{\rho_2}{\rho_1}}$.

Justified: adiabat of ideal gas $\frac{p}{p_0} = (\frac{\rho}{\rho_0})^{1+\frac{2}{i}}$, $i = n_{\text{translat}} + n_{\text{rotat}} + 2n_{\text{vibrat}}$, speed of sound $a = \sqrt{(1+\frac{2}{i})\frac{RT}{\mu}}$, $i = n_{\text{translat}} + n_{\text{rotat}} + 2n_{\text{vibrat}}$ adiabat percussion wave $\frac{p_2}{p_1} = \frac{(1+i)\frac{\rho_2}{\rho_1} - 1}{(1+i) - \frac{\rho_2}{\rho_1}}$,

$i = n_{\text{translat}} + n_{\text{rotat}} + 2n_{\text{vibrat}}$.

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ПУАССОН, ГЮГОНИО АДИАБАТЫ, ЛАПЛАС ДЫБЫС ЖЫЛДАМДЫҒЫНЫҢ ЖАСАНДЫЛЫҒЫ. ТЕРМОДИНАМИКА НЕГІЗДЕРІН ЖАҢҒЫРТУ

Аннотация. Термодинамиканың бірінші заңынан шығарылған термодинамиканың негізгі формуласы болып есептелетін тұжырымдама жасандылығы сипатталған. Тұрақты көлемдегі газдың тұрақты қысымы мен жылу сыйымдылығы бар газдың жылу сыйымдылығының әмбебап газ тұрақты айырмашылығының теңсіздігі дәлелденді.

Тұрақты көлемдегі жылу сыйымдылығы бар адиабатты газдағы температураға қысымның тәуелділік формуласы қорытылды. Тұрақты қысым, энтальпия, Пуассон адиабаты, Лаплас дыбыс жылдамдығы, гюгонио адиабаты кезінде газдың жылу сыйымдылығын термодинамикада қолданудың жасандылығы мен физикалық еместігі дәлелденді, онда тұрақты көлемде газдың жылу сыйымдылығымен тұрақты қысым кезінде газдың жылу сыйымдылығының әмбебап газды тұрақты айырмашылығының жасанды теңдігі қолданылды.

Тартылыс күші өрісінде қысымның айнымалдылығы дәлелденді. Газ-динамикалық формулаларда тұрақты қысым кезінде идеалды газдың нақты коэффициентін қолдану мағынасыз екендігі көрсетілген. Жасанды «термодинамиканың негізгі формуласы» тұрақты қысым кезінде нақты жылу сыйымдылығы коэффициентімен жасанды жылу теңдеуіне әкелетіні көрсетілген. Тұрақты көлемдегі мінсіз газдың жылу сыйымдылығына сүйене отырып, идеалды газ адиабаты үшін жаңа формула, соққы толқынындағы адекватты адиабат, дыбыс жылдамдығының жаңартылған формуласы анықталды, олар, негізінен, тұрақты қысым кезінде газдың нақты жылу сыйымдылығы коэффициентін қамтымайды. Тұрақты қысымдағы газдың жылу сыйымдылығы коэффициенті бар белгілі жылу өткізгіштік теңдеуі тұрақты көлемдегі газдың жылу сыйымдылығы коэффициентімен энергия балансының негізгі теңдеуіне қайшы келетіні көрсетілген.

Түйін сөздер: дыбыс жылдамдығы, жылу сыйымдылық, адиабата, изобарлық, изотермалық.

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ФАЛЬСИФИКАЦИИ АДИАБАТЫ ПУАССОНА, АДИАБАТЫ ГЮГОНИО, СКОРОСТИ ЗВУКА ЛАПЛАСА. МОДЕРНИЗАЦИЯ ОСНОВ ТЕРМОДИНАМИКИ

Аннотация. Излагаются фальсификации вывода из первого закона термодинамики основной формулы термодинамики. Доказано неравенство универсальной газовой постоянной разности теплоемкости газа при постоянном давлении с теплоемкостью газа при постоянном объеме. Установлена формула зависимости давления от температуры в адиабатическом газе с теплоемкостью при постоянном объеме. Доказаны фальсификации и нефизичность применения в термодинамике теплоемкости газа при постоянном давлении, энтальпии, адиабаты Пуассона, скорости звука Лапласа, адиабаты Гюгонио, в которых применено фальшивое равенство универсальной газовой постоянной разности теплоемкости газа при постоянном давлении с теплоемкостью газа при постоянном объеме.

Доказана переменность давления в поле силы тяжести. Указано, что использование удельного коэффициента идеального газа при постоянном давлении в газодинамических формулах бессмысленно. Показано, что ложная «основная формула термодинамики» приводит к фальшивому уравнению теплопроводности с коэффициентом удельной теплоемкости при постоянном давлении. Основываясь на теплоемкости совершенного газа при постоянном объеме, установлены новая формула для адиабаты идеального газа, адекватная адиабата на ударной волне, модернизированная формула скорости звука, которые, в принципе, не содержат коэффициента удельной теплоемкости газа при постоянном давлении. Показано, что известное уравнение теплопроводности с коэффициентом теплоемкости газа при постоянном давлении противоречит основному уравнению баланса энергии с коэффициентом теплоемкости газа при постоянном объеме.

Ключевые слова: скорость звука, теплоемкость, адиабата, изобарический, изотермический.

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