

GASTAB Program

Example Screens

Version 1.0

January 2003

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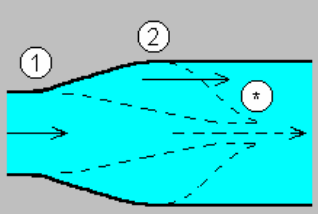
Gas Tables (GASTAB) Program – Example Screens

GAS TABLES

File Help Units

CONICAL SHOCK | MULTIPLE SHOCKS | PRANDTL-MEYER FLOW | DUMP DIFFUSER
 ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | OBLIQUE SHOCK

Adiabatic frictionless flow with area change, for steady flow of a calorically perfect gas



ratio of specific heats Cp/Cv	1.40
mean molecular weight	28.95 lbm/lbm-mol
Mach number M	1.0000 <input checked="" type="checkbox"/>
pressure ratio P/Pt, Eq. (1.2)	0.52828 <input type="checkbox"/>
density ratio rho/rho-t	0.63394 <input type="checkbox"/>
temperature ratio T/Tt, Eq. (1.1)	0.83333 <input type="checkbox"/>
area ratio A/A*, Eq. (10.19)	1.0000 <input type="checkbox"/>
impulse function ratio I/I*, Eq. (1.5)	1.0000 <input type="checkbox"/>
(A/A*)(P/Pt)	0.52828 <input type="checkbox"/>
mass flow parameter MFP, Eq. (1.3)	0.53161 <input type="checkbox"/>
static pressure " " MFP, Eq. (1.4)	1.0063 <input type="checkbox"/>

units for MFP and MFP: lbm^2 R^1/2/s-lbf

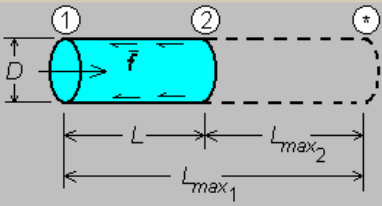
$$\left(\frac{A_2}{A_1}\right)_{\text{isen}} = \left(\frac{A}{A^*}\right)_2 \left(\frac{A^*}{A}\right)_1$$

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Constant-area adiabatic flow with wall friction, for steady flow of a calorically perfect gas.



ratio of specific heats Cp/Cv	1.40
Mach number M	1.0000 <input checked="" type="checkbox"/>
static temperature ratio T/T*	1.0000 <input type="checkbox"/>
static pressure ratio P/P*	1.0000 <input type="checkbox"/>
total pressure ratio Pt/Pt*	1.0000 <input type="checkbox"/>
velocity ratio V/V*	1.0000 <input type="checkbox"/>
impulse function ratio I/I*	1.0000 <input type="checkbox"/>
friction factor 4fLmax/D	0.0000 <input type="checkbox"/>

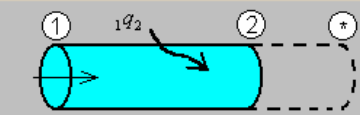
$$4\bar{f}\frac{L}{D} = \left(4\bar{f}\frac{L_{\text{max}}}{D}\right)_1 - \left(4\bar{f}\frac{L_{\text{max}}}{D}\right)_2$$

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Constant-area frictionless flow with heat addition or removal, for steady flow of a calorically perfect gas.



ratio of specific heats Cp/Cv	1.40
Mach number M	1.0000 <input checked="" type="checkbox"/>
total temperature ratio Tt/Tt*	1.0000 <input type="checkbox"/>
static temperature ratio T/T*	1.0000 <input type="checkbox"/>
static pressure ratio P/P*	1.0000 <input type="checkbox"/>
total pressure ratio Pt/Pt*	1.0000 <input type="checkbox"/>
velocity ratio V/V*	1.0000 <input type="checkbox"/>

$$1q_2 = \frac{T_{t2} - T_{t1}}{C_p}$$

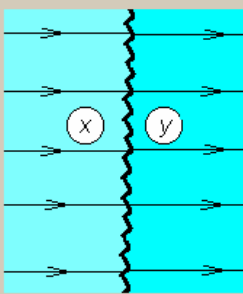
$$\frac{T_{t2}}{T_{t1}} = \left(\frac{T_t}{T_{t*}}\right)_2 \left(\frac{T_{t*}}{T_t}\right)_1$$

GAS TABLES

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CONICAL SHOCK | MULTIPLE SHOCKS | PRANDTL-MEYER FLOW | DUMP DIFFUSER
 ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | OBLIQUE SHOCK

Pre- and post-shock Mach number and property ratios for normal shock waves, for steady flow of a calorically perfect gas.



ratio of specific heats Cp/Cv	1.40
upstream Mach # Mx	1.0000 <input checked="" type="checkbox"/>
downstream Mach # My, Eq. (10.10)	1.0000 <input type="checkbox"/>
static pressure ratio Py/Px	1.0000 <input type="checkbox"/>
velocity Vx/Vy, rho-y/rho-x	1.0000 <input type="checkbox"/>
total temperature ratio Ty/Tx	1.0000 <input type="checkbox"/>
Ax*/Ay*, Pty/Ptx, Eq. (10.9)	1.0000 <input type="checkbox"/>
total-to-static pressure ratio Pty/Px	1.8929 <input type="checkbox"/>

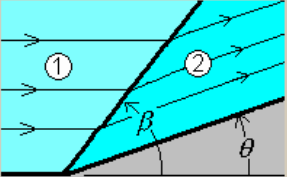
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CONICAL SHOCK | MULTIPLE SHOCKS | PRANDTL-MEYER FLOW | DUMP DIFFUSER
 ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | **OBLIQUE SHOCK**

Pre- and post-shock Mach numbers and property ratios for planar oblique shock waves, for steady flow of a calorically perfect gas.



ratio of specific heats Cp/Cv 1.40
 upstream Mach number M1 1.50

turning angle theta (deg) 8.1853
 wave angle beta (deg) 52.906
 downstream Mach # M2 1.2000
 temperature ratio T2/T1 1.1258
 pressure ratio P2/P1 1.5035
 density ratio rho2/rho1 1.3355
 total pressure ratio Pt2/Pt1 0.99313

WEAK SHOCK

GAS TABLES

File Help Units

ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | OBLIQUE SHOCK
 CONICAL SHOCK | **MULTIPLE SHOCKS** | PRANDTL-MEYER FLOW | DUMP DIFFUSER

Multiple weak oblique shocks of equal turning angle, for steady flow of a calorically perfect gas.

specific heat ratio Cp/Cv 1.36
 freestream Mach number Mo 10.00
 desired number of shocks N 3

temperature rise ratio T2/To 7.000
 pressure rise ratio P2/Po 209.1
 area contraction ratio Ao/A2 24.39

Each shock turns the flow through an angle 14.24 deg

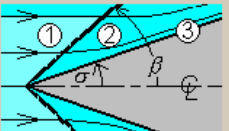
	M	T/To	P/Po	Ao/A	Pt/Pto	(S-So)/Cp
1	5.709	2.767	11.82	4.056	0.2528	0.3640
2	4.061	4.787	60.56	11.24	0.1633	0.4797
3	3.086	7.000	209.1	24.39	0.1342	0.5316

GAS TABLES

File Help Units

ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | OBLIQUE SHOCK
CONICAL SHOCK | MULTIPLE SHOCKS | PRANDTL-MEYER FLOW | DUMP DIFFUSER

Freestream (1), post-shock (2) and cone surface (3) Mach numbers and property ratios for weak oblique shock waves over a cone, for steady flow of a calorically perfect gas.



ratio of specific heats Cp/Cv 1.40
 freestream Mach number M1 10.00
 cone half-angle sigma (deg) 5.00
 shock wave angle beta (deg) 7.73

WEAK SHOCK

POST-SHOCK (2)

Mach number M2	9.0040
temperature ratio T2/T1	1.2199
pressure ratio P2/P1	1.9462
density ratio rho2/rho1	1.5954
total pressure ratio Pt2/Pt1	0.97063

CONE SURFACE (3)

Mach number M3	8.7725
temperature ratio T3/T1	1.2812
pressure ratio P3/P1	2.3104
density ratio rho3/rho1	1.8033
total pressure ratio Pt3/Pt1	0.97063

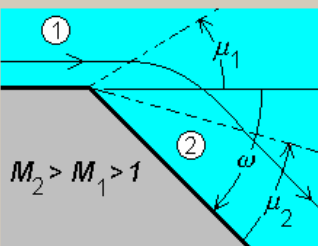
GAS TABLES

File Help Units

ISENTROPIC FLOW | RAYLEIGH FLOW | FANNO FLOW | NORMAL SHOCK | OBLIQUE SHOCK
 CONICAL SHOCK | MULTIPLE SHOCKS | **PRANDTL-MEYER FLOW** | DUMP DIFFUSER

Isentropically turning a supersonic flow through an angle omega, for steady flow of a calorically perfect gas.

ratio of specific heats Cp/Cv 1.40
 upstream Mach number M1 2.00



turning angle omega (deg) 39.405
 downstream Mach number M2 4.0000
 temperature ratio T2/T1 0.42857
 pressure ratio P2/P1 5.15325E-02
 density ratio rho2/rho1 0.12024
 area ratio A2/A1 6.3519
 upstream Mach angle mu1 (deg) 30.000
 downstream Mach angle mu2 (deg) 14.478

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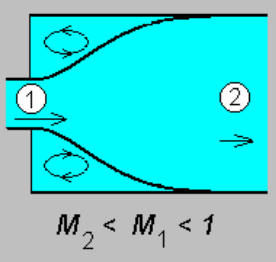
GAS TABLES
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File Help Units

ISENTROPIC FLOW
RAYLEIGH FLOW
FANNO FLOW
NORMAL SHOCK
OBLIQUE SHOCK

CONICAL SHOCK
MULTIPLE SHOCKS
PRANDTL-MEYER FLOW
DUMP DIFFUSER

Subsonic flow through a "sudden expansion" of a calorically perfect gas.



$M_2 < M_1 < 1$

ratio of specific heats Cp/Cv	1.40
upstream Mach number M1	0.5000
downstream Mach number M2	0.1200 <input type="checkbox"/>
area ratio A2/A1	4.000 <input checked="" type="checkbox"/>
pressure recovery coefficient CP = (P2 - P1)/q1	0.37723
isentropic press. rec. coeff. ((P2 - P1)/q1)isen	1.0083
diffuser efficiency/effectiveness CP/CPisen	0.37414
total pressure loss coefficient (P1 - P2)/q1	0.62524
total pressure ratio Pt2/Pt1	0.90776