Contents

		Introduction	4
		List of markings	7
1.	Fund	amentals of flow of compressible fluids	9
	1.1	Basic thermodynamic relations for ideal gas	9
	1.2	Basic equations of compressible fluid flow	10
		1.2.1 Continuity equation	11
		1.2.2 The equation of motion	12
		1.2.3 The energy equation – the first law of thermodynamics 1.2.4 The law of entropy	13 13
	1.3	Compressibility	14
	1.4	Speed of sound	14
	1.5	Moving sound source	15
	1.6	Distribution of flow of compressible fluids	17
	1.7	Fundamentals of flow of compressible fluids - examples	18
		1.7.1 Calculation of the specific gas constant and heat capacity of the ideal gas	18
		1.7.2 Calculation of the specific gas constant and the speed of sound for air	19
		1.7.3 The dependence of the sound velocity and Mach number on the temperature of air	19
		1.7.4 The dependence of the sound velocity and Mach number on the molar mass of gas	20
2.	One-	dimensional steady isentropic flow of ideal gas	23
	2.1	The basic equation for control volume	23
	2.2	The speed during isentropic expansion	24
	2.3	Critical flow conditions of an ideal gas	24
	2.4	The difference between supersonic and subsonic flow	25
	2.5	The flow in convergent nozzles at different pressure ratios	26
	2.6	Mass flow in a tapered nozzle	28
	2.7	The flow in convergent - divergent nozzles	29
	2.8	Losses and efficiency of nozzles and diffusers	30
	2.9	The flow in a gas ejector	31
	2.10	Dynamic functions in isentropic flow of an ideal gas	34
	2.11	One-dimensional steady isentropic flow of ideal gas - examples	35
		2.11.1 Flow in convergent nozzles at different pressure ratios	35
		2.11.2 Design of nozzles for critical flow conditions	37
		2.11.3 Design of convergent - divergent nozzles	38
		2.11.4 Aerodynamic choking	39

	2.11.5 Flow in convergent - divergent nozzles	40
	2.11.6 Isentropic flow in a channel of complex shape	41
	2.11.7 Subsonic diffuser	43
	2.11.8 Design of subsonic diffuser	44
	2.11.9 Determining the static state given the mass flow rate in a pipe	45
	2.11.10 Determining the stagnation state given the backpressure	47
	2.11.11 Calculation of the ideal air ejector	49
Intr	oduction to the flow of compressible fluids - Appendix	53
1.	T-s Diagram for ideal air	54
2.	Diagram of the dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$	55
3.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part $1/6$.	56
4.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part 2/6.	57
5.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part 3/6.	58
6.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part $4/6$.	59
7.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part 5/6.	60
8.	Dynamic functions of isentropic flow of an ideal gas for $\kappa = 1.4$, part 6/6.	61
	List of recommended literature	62