Questionnaire on Gas Dynamics

Questionnaire on Gas Dynamics 1

https://www.youtube.com/watch?v=TZkkdyHtl-A

0:00 Why the density is outside of the substantial derivative in the momentum equation
19:35 What are the total conditions
22:15 Definition of the total conditions for incompressible flow
25:26 Definition of the total conditions for compressible flow

Questionnaire on Gas Dynamics 2

https://www.youtube.com/watch?v=Ii452zObFa8

0:00 Why should the flow be isentropic (reversible) to have constant stagnation pressure and density?
12:21 Obtaining algebraic form of the energy equation from its integral form
21:51 Practical application of the stagnation enthalpy and temperature in the gas dynamics
29:11 Stagnation speed of sound
33:35 Characteristic speed of sound
41:14 Characteristic flow properties
42:38 Practical application of the relation between Characteristic and Stagnation flow properties

Questionnaire on Gas Dynamics 3

https://www.youtube.com/watch?v=Jo7AptdVBiw

0:00 What is the free-stream Mach number?
1:59 When the flow is compressible?
4:10 How far from the body the flow properties are considered constant?
5:00 What if M is close to 0.3?
7:00 Characteristic flow properties (applications)
18:43 Limits of the characteristic Mach number
21:23 How to use tables to calculate the shockwaves or isentropic flow properties?
27:09 Validation of the simulation in one program by the other one

Questionnaire on Gas Dynamics 4

https://www.youtube.com/watch?v=SpO_mUuM0-k

0:00 Calculation of the flow properties in isentropic and non-isentropic cases (normal shock-wave)
28:39 Comment about the Lambda-shock-wave in the nozzle

30:20 Mach number as a function of the pressure
31:33 Limits of constant Cp, Cv, R, gamma and isentropic conditions

Questionnaire on Gas Dynamics 5
https://www.youtube.com/watch?v=1_vYpoBmlNA

0:00 Introduction
0:25 Left-running and right-running shockwaves, the concept of the shockwave interaction model
5:12 Why are the expansion waves isentropic?
7:21 Oblique shockwave and boundary layer interactions

Recommended literature: Shock Wave-Boundary-Layer Interactions (Cambridge Aerospace Series Book 32) 1st Edition, 480 pages, 2011, ISBN-13: 978-0521848527

Questionnaire on Gas Dynamics 6
https://www.youtube.com/watch?v=hqd9jqoH83c

0:00 What is an optimal diffuser inlet?
1:03 Geometry of a 3-shock-wave diffuser
5:34 Losses in a shock-wave
14:48 Total losses in a diffuser
18:38 Optimization parameters in diffuser design and their limits
26:54 References to the textbooks about oblique shock-wave calculations, book: R. Hermann, Supersonic inlet diffusers and introduction to internal aerodynamics, Minneapolis, 1956
28:32 What are the Chapters to study for Work 1
29:31 Planning the TCC in Aero- Gas- Dynamics or Propulsion (experimental or numerical) http://fga.unb.br/olexiy/sugestoes-de-tcc-e-pibic

Questionnaire on Gas Dynamics 7
https://www.youtube.com/watch?v=VMU-29f0Hiw

Chapter 9: Oblique Shock and Expansion Waves
Aspects of the oblique shock-waves and optimal diffuser calculation

Questionnaire on Gas Dynamics 8
https://www.youtube.com/watch?v=0ygzm3LT0VE
Simulation of Supersonic Diffusers and Nozzles

0:00 How to prevent the normal shockwave from going out from the diffuser destroying the oblique shockwaves and blocking the flow (case 1)
5:14 Moving normal shockwave (case 2)
6:15 Flow starts to diverge after some iterations
10:19 Other geometry problem in the subsonic section
13:11 The exit pressure problem
14:45 Why the residuals rise (another explanation)
16:39 Importance of studying the Gas Dynamics course
17:26 Evaluation problems in the Gas Dynamics course
18:52 About the oral test planning
20:25 Oral test subjects

Questionnaire on Gas Dynamics 9
https://www.youtube.com/watch?v=nwSEv3kdmT0
The solution of the practical tasks for the oral test - part 1

0:00 Introduction
0:36 Normal shockwave, example 1
3:57 Normal shockwave, example 2
4:47 Normal shockwave, example 3
7:24 Normal shockwave, example 4
9:52 Normal shockwave, example 5
15:06 Normal shockwave, example 6
23:28 Oblique shockwave, example 2.1a
31:19 Oblique shockwave, example 2.1b
41:35 Oblique shockwave, example 2.2
47:29 Oblique shockwave, example 2.3a
50:16 Oblique shockwave, example 2.3b
52:36 Oblique shockwave, example 2.3c
55:43 Oblique shockwave, example 2.4

Questionnaire on Gas Dynamics 10
https://www.youtube.com/watch?v=HmIBqIMExtI
The solution of the practical tasks for the oral test - part 2

0:00 Mach-area relation, example 3.1a
13:51 Mach-area relation, example 3.1b
16:02 Mach-area relation, example 3.2
27:49 Mach-area relation, example 3.3
30:31 Mach-area relation, example 3.4
39:54 Mach-area relation, example 3.5
40:24 Mach-area relation, example 4 with error and further correction

Questionnaire on Gas Dynamics 11
https://www.youtube.com/watch?v=G2nVpmHs2uY
The solution of the practical tasks for the oral test - part 3 AND Simulation in Ansys Fluent

0:00 No convergence of the viscous flow simulation
4:42 Oblique shockwave in a non-isentropic nozzle
10:19 Convergence of the flow in the nozzle
12:12 Simulation of the flow in the nozzle of the low area ratio
14:44 Isentropic flow, introduction to examples
17:53 Isentropic flow, example 5.1
22:44 Isentropic flow, example 5.2
28:11 Isentropic flow, example 5.3
33:00 Isentropic flow, example 5.4
39:44 Expansion waves, introduction to examples
45:04 Expansion waves, example 6.1
51:29 Expansion waves, example 6.2
56:22 Expansion waves, example 6.3a
58:53 Expansion waves, example 6.3b
1:01:14 Final considerations on the solution of the practical tasks

Questionnaire on Gas Dynamics 12
https://youtu.be/yNePBidaCpQ
Chapter 9: Oblique Shock and Expansion Waves
Aspects of the oblique shock-waves and optimal diffuser calculation continuation of part 7: https://www.youtube.com/watch?v=_1uWVWNnheM)

Questionnaire on Gas Dynamics 13
https://youtu.be/zwwnn5SS-jk
Compressible Flow in a Variable-Area Duct
Sound channel overlapping happened due to the recording program error. Sorry!!!
0:00 Introduction
4:41 Flow expansion (transition from region 3 to 4)
12:56 Heat addition
21:17 Flow in the nozzle
24:03 Calculation example
37:00 Finding the internal and external diffuser size (D and Dint)
42:47 Why three shock waves coincide at the same point?
47:13 Limitations of the Area-Mach number relation (shaping of the nozzle)
50:27 Another comment about the diffuser size D

51:34 Conical and bell-shaped nozzle flow results
54:37 About a wrong approach to do works in gas dynamics
57:00 Can I opt to modify a diffuser or nozzle geometry?
59:35 The diffuser and nozzle are planar and not axis-symmetrical.
1:03:32 Is there any advantage to use a cylindrical ramjet?
1:06:28 Why we don't see ramjets in everyday life?
1:09:04 Peaceful applications of ramjets
1:09:54 Just look on the SpaceX…

Additional links:

Mach-area relation: **https://www.youtube.com/watch?v=HmlBqlMExtI**
The geometry of a 3-shock-wave diffuser: **https://www.youtube.com/watch?v=hqd9jqoH83c**
How to use tables to calculate the shockwaves or isentropic flow properties?
https://www.youtube.com/watch?v=Jo7AptdVBiw

Literature:

1. Anderson, J. Fundamentals of Aerodynamics, McGraw-Hill, 6th edition, 2016.
2. BERTSEKAS, Dimitri P; NEDIC, Angelia; OZDAGLAR, Asuman E. Convex analysis and optimization. Belmont: Athena Scientific, 2003. xv, 534 p. ISBN 1886529450
3. ANDERSON, John David. Modern compressible flow: with historical perspective. 3rd ed. New York: McGraw-Hill, 2003. xvi, 760 p. ISBN 9780072424430).

Questionnaire on Gas Dynamics 14

https://youtu.be/arS9ZG2iL0Q

Compressible Flow in a Variable-Area Duct

Sound channel overlapping happened due to the recording program error. Sorry!!!
0:00 Questions asking: thrust optimization, the optimal exit of the diffuser
3:14 Answer 1: from the point of view of the thrust optimization problem
3:45 Answer 2: the optimal exit of the diffuser and its relation with all the subsonic flow region
19:38 Drag calculation on a diffuser
28:51 Drag calculation on a diffuser: an additional question - pressure variation in a subsonic section
32:16 Application of the theorem of the average value to drag calculation
35:46 Matlab implementation of the Area-Mach number relation
41:40 Matlab implementation of a diffuser optimization algorithm
46:34 Matlab implementation of a heat addition algorithm in
49:01 How to evaluate maximum possible heat addition (dT)