## Assignment 2 Cycle Analysis of the Jet Engine based on Nasa tables

Applying conservation equations and the Nasa tables fill out table 2.1. The code and approach should be explained in detail in the following pages. As an example a worked-out part is given for the diffusor (page 5)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| State | **1** | **2** | **3** | **4** | **5** | **6** |
| P (kPa) | 55.00 | 71.84 | 502.88 | 502.88 | 158 | Pamb=55.00 |
| T (K) | 250 | 269.88 | 468.32 | 1009.3 | 834.62 | 634.29 |
| v (m/s) | 200 | ~0 | ~0 | ~0 | ~0 | 666.66 |
| ***Table 2.1: Thermodynamic state summary*** | | | | | | |

## Diffusor

|  |
| --- |
|  |
| Code snippet diffusor [1-2] |

### Procedure

**Determine**

Solved is first (**line nr**)



to determine *T2* then applying isentropic compression to solve for the pressure (**line nr**)

.

Mixture properties determined using f.i. (e.g. **line nr**)



The composition *Yi* is taken equal to that of normal air.

s1=s2 (fig 8.19). Also is equal to zero according to energy conservation.

## Compressor

|  |
| --- |
|  |
| Code snippet Compressor [2-3] |

### Procedure

**Determine**

Conservation of energy gives:

No according to energy conservation so equals zero.

Since , and is known, and can be found with nasa tables.

With , can be calculated.

## Combustor

|  |
| --- |
|  |
| Code snippet Combustor [3-4] |

### Procedure

**Determine and complete table 2.2**

Energy conservation:

So equals zero again.

equals (see fig.8.19)

According to slide 13 2nd presentation is given ? so

Complete table 2.2 (**don’t forget to assign values for he question marks**)

|  |  |  |
| --- | --- | --- |
|  | **AF=71.25 (equivalence ratio=1)** | |
| **Mass fractions** | Initial | Final |
| Fuel | 0,0138408304498270 | 0 |
| O2 | 0,229693739672700 | 0 |
| N2 | 0,756465429877473 | 0.753 |
| CO2 | 0 | 0.184 |
| H2O | 0 | 0.063 |
| **Table 2.2: Mixture composition before and after the combustor** | | |

An example calculation for nitrogen initial:

## Turbine

|  |
| --- |
|  |
| Code snippet Turbine [4-5] |

### Procedure

Determine

According to conservation of energy:

And since: we can write:

Therefore we can calculate since we know that .

No according to energy conservation so equals zero.

## Nozzle

|  |
| --- |
|  |
| Code snippet Nozzle [5-6] |

### Procedure

Determine

And since we know that: we can find and with nasa.

according to energy conservation:

Now it is also possible to calculate