ES-211 Project User Manual

Group 1

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Substance: CH4
Combo-1: P-v, T-v, P-s

Steps for setting up

1. Download the .zip folder containing the files.
2. Extract the 'CH4 Properties Group 1' folder onto your local computer.
3. Open the folder path of 'CH4 Properties Group 1' in MATLAB. You will be able to see 3 MATLAB function files and 1 xlsx file named 'CH4.xlsx'.
4. Call the functions from the command line as required.

Steps for accessing data using the function

The three functions will return an output array Properties[p; v; T; u; h; s; x]
Here,

'p' is the value of pressure in Pa
'v' is the value of volume in m^3/kg
'T' is the value of temperature in K
'u' is the value of specific internal energy in J/kg
'h' is the value of specific enthalpy in J/kg
's' is the value of specific entropy in J/kg-K
'x' is the vapour fraction/quality of CH4

1. SetProperties_CH4_PV(P,v)

    a. Type the function in the command window with input parameters
    Here, ‘p’ is the value of pressure in Pa and ‘v’ is the value of volume in m^3/kg
    b. Run the file

2. SetProperties_CH4_TV(T,v)

    a. Type the function in the command window with input parameters
    Here, ‘T’ is the value of temperature in K and ‘v’ is the value of volume in m^3/kg
    b. Run the file

3. SetProperties_CH4_PS(P,s)

    a. Type the function in the command window with input parameters
    Here, ‘P’ is the value of pressure in Pa and ‘s’ is the value of specific entropy in J/kg-K
    b. Run the file

Note

1. Ensure that for the functions ‘SetProperties_CH4_PV’ and ‘SetProperties_CH4_PS’ the pressure value given is more than 20000 Pa. Similarly for the ‘SetProperties_CH4_TV’ make sure the temperature value given is between 95 K and 185 K. If you enter a value outside the specified limits, an error message will appear.
2. If the input parameters lie within the dome, the output will be an array to the corresponding input values.
3. If the input pressure value is not above the critical pressure for methane (i.e. 4.5 MPa) then an output array will be obtained for the three functions.
4. If the input parameters lie in the subcooled region, there will be an error displayed as the data for that region has not been provided.
5. For cases in the superheated region, that lie beyond the given ranges of values in the database, there might be some discrepancies in results. (limitation of the database for interpolation and extrapolation of values)
    Temperature values above 228.666 K are not allowed and an error will be displayed.

6. **Due to MATLAB's inbuilt rounding off of vectors according to same scale scaling, values in the output vector 'Properties' will seem absurd (0.000 for some).**

   Hence, the developers have also printed the actual values of the variables all the properties individually in the exact same order as the vector, retaining their magnitude and units.

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This project has helped us immensely in furthering our knowledge and grasp of the fundamental concepts of thermodynamics while at the same time helped us in learning how to robustly code in MATLAB and get familiar with its syntax and in built functions.

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