Modelling for Linear and Radial Heat Transfer using 3D Experience

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Abstract – *This paper deals with development of models for design of one-dimensional steady state heat conduction and heat conduction in cylinder using Catia dymola behavior modeling software (3dexperiance). Using the developed model, one can estimate the amount of heat conducted through different selected materials linearly as well as radially.*

Key Words: *One-dimensional steady state Heat conduction, 3dexperiance.*

1.INTRODUCTION

Heat transfer basically deals with the transfer of heat from one surface to another. In the model heat gets transferred in 1D through wall, this wall can be of any selected material according to our preference. Thus, the linear heat transfer rate (Q) through the material is calculated.

Similarly, the second code deals with radial heat transfer through pipes, thus we get the values of temperature at different stages.

1.1 Software used

Catia dymola behavior software, This software deals with the modeling, design, and analysis of different models through blocks or through code for simulation. This is a powerful modeling and simulator which givers approximate/accurate solution. This software can do engineering-based processes for automobile, robotics, aerospace, which will help specifically Mechanical and Civil engineering students to visualize and see the results of their model.

1.2 Steps to create a model

1.2.1 Open dymola behavior modelling app

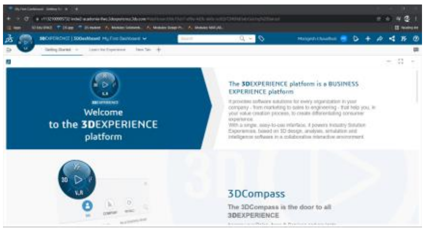

Fig-1: Overview of 3dplm

- Start Dymola a Dymola window appears.
- By using the credentials given log in into the portal.
- Start the behaviour modelling app an in-built library will be present for accessing different library go through the following steps

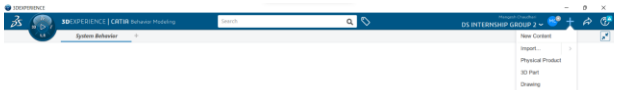

Fig-2: Task bar for dymola app

- Click on the plus sign
- Then import an option and select the file that you want to import.
- Click on ok button

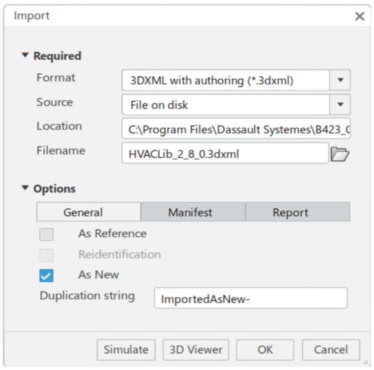

Fig-3: Importing a file

2. SIMULATION OF MODEL

2.1 One dimensional heat transfer through walls

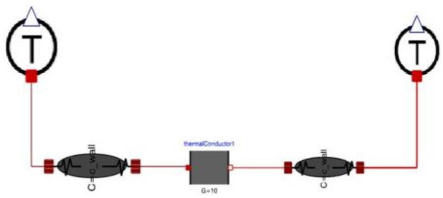

Fig-4: Dymola Behavior model

The above figure is about the 1D heat transfer through walls of selected material;

2.1.1 Loading required blocks

- Modelica>Thermal>Heat_Transfer>Components>Thermal_ conductor
- Claytex>Thermal >WallModel>Wall1D
- ThermalSystems>Thermal >Multiportsensor_T

2.1.2 Joining the blocks

Directly by clicking on one end and dragging it to other block ends the connections can be done. An option is present as auto join by clicking on it which will automatically join 2 blocks that are selected.

2.1.3 Setting parameters

By double clicking on the blocks, we can set the parameters

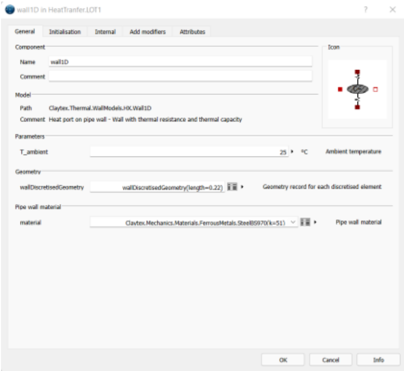

Fig-5: Defining wall material and geometry

2.1 Heat conduction in Cylinder

For writing code select the Modelica editor in Modelica app as given below

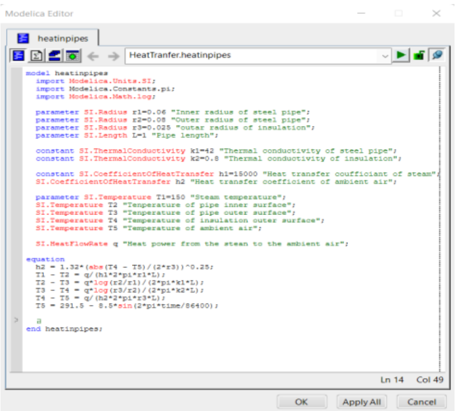

Fig-6: Code in modelica

3. Results

3.1 Result for 1D Heat Transfer

Following are the results for 1D heat transfer where the initial temperature supplied to the wall was 473 K° after conduction through asbestos whose thermal conductivity is 0.084.

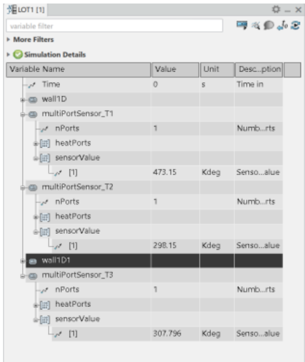

Fig-7: Results for 1d heat transfer

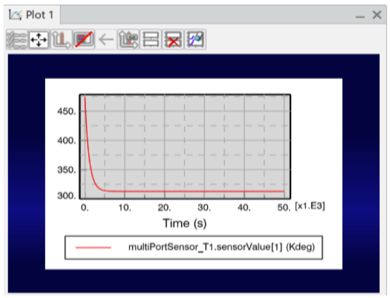

Fig-8: Graph for temperature at initial port

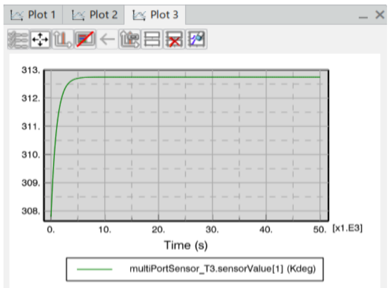

Fig-9: Graph for temperature at final port

3.2 Results for Heat conduction in Cylinder

Following are the results for the model of heat condition in cylinder where the thermal constant of material and the radius of cylinders is given with the radius of insulation. The temperature and change in temperature is calculated which conducts through the insulation and is transmitted to the atmosphere.

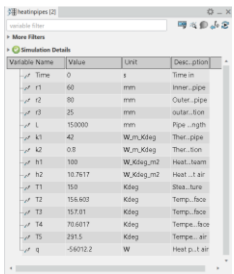

Fig-10: results for heat conduction in cylinder

4. CONCLUSION

As the results obtained using developed model are comparable with analytical solution. Hence these models can be used to calculate Rate of Heat Transfer linearly and radially.

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