

Computer-Aided Project of 2020 Numerical Heat Transfer

Xi'an Jiaotong University

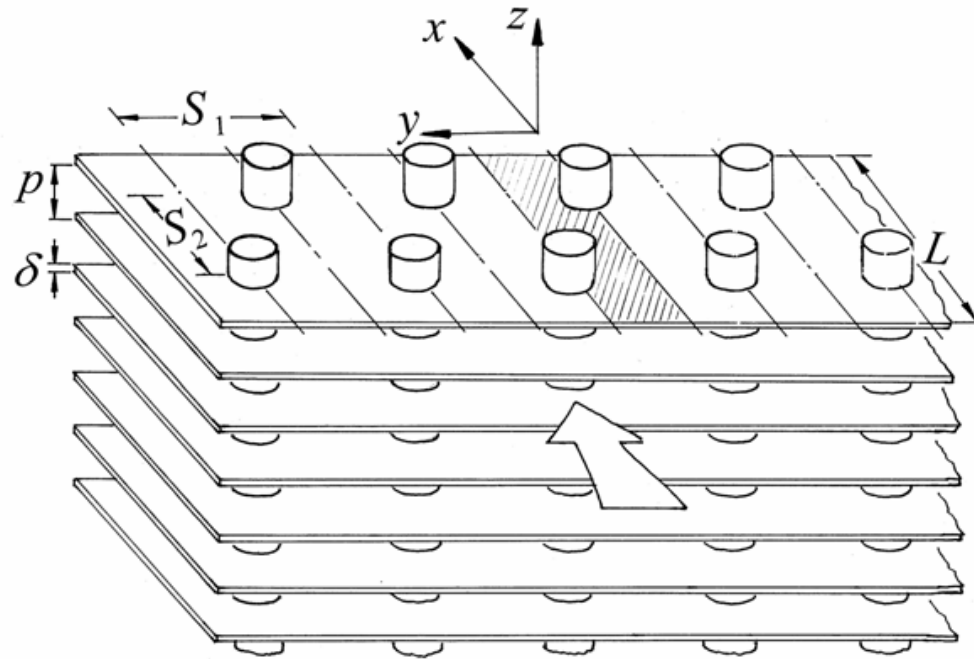
We present three computer-aided projects: one is to be solved by our teaching code (Project 1) , the 2nd and 3rd ones are to be solved by FLUENT (Fundamental , Project 2, Intermediate Project 3) . Every student can choose one project according to your interest and condition.

For the first project the self-developed computer code should attached in your final report.

For the second and third project Class F and Class I will have different projects. The instructors will assign the project at the end of the lecture.

Computer-Aided Project (1) of NHT-2020, Xi'an Jiaotong University (Laminar forced convection across slotted fin surface)

1.Engineering problem

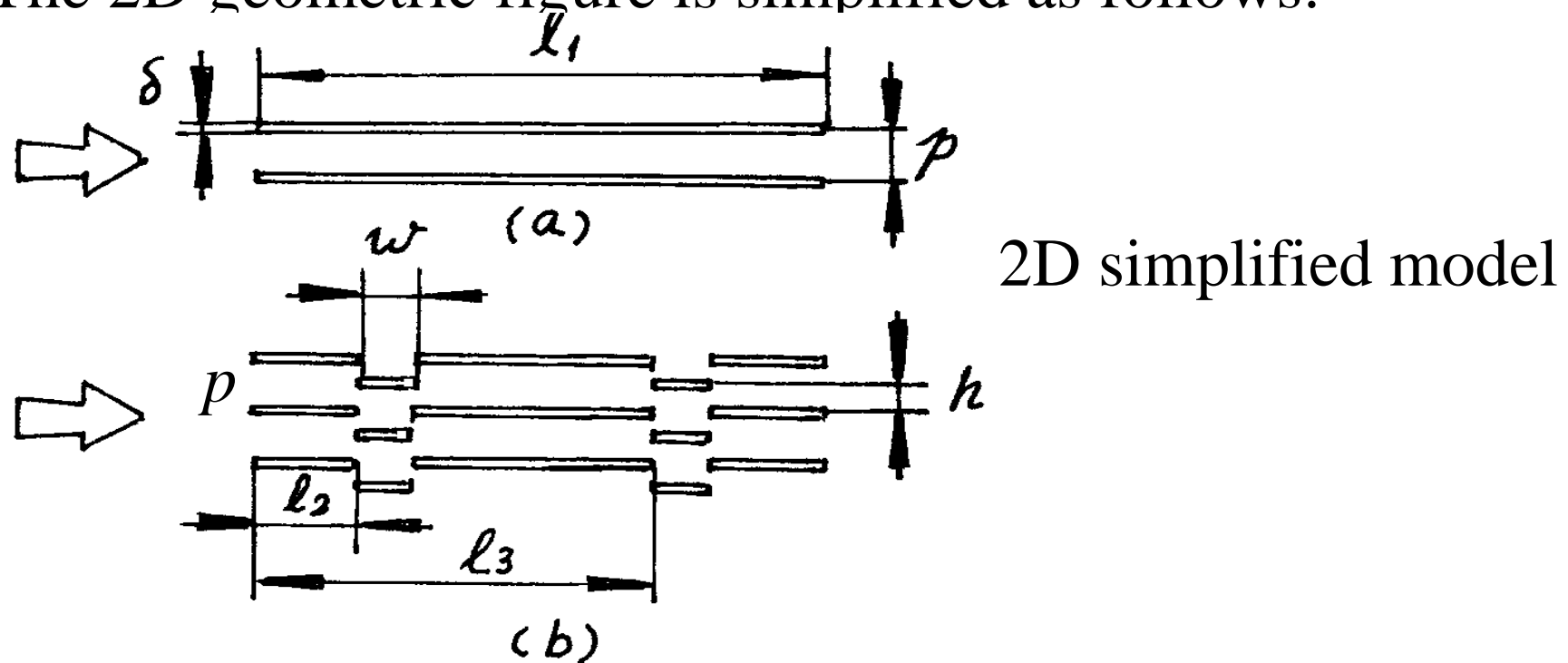


Fin and tube hear exchangers

Slotted fin surfaces(开缝翅片)

2. Simplification Assumptions:

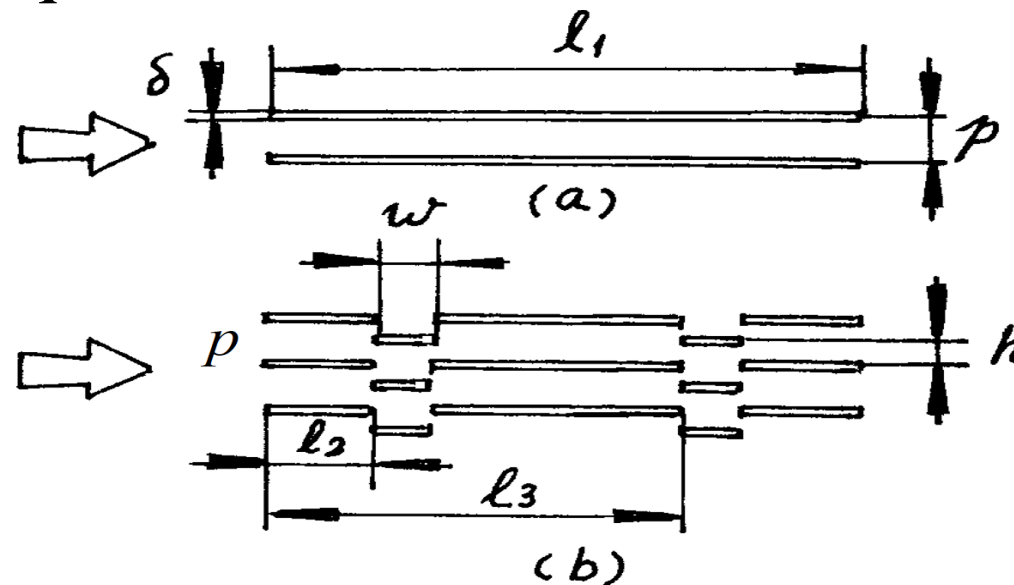
- (1) Flow and heat transfer are in steady state and laminar;
- (2) Fluid is air and thermo-physical properties are constant.
- (3) The 2D geometric figure is simplified as follows:



(a) Continuous fin surface for comparison (b) Slotted fin surface

3. Given conditions

- (1) Air inlet temperature is $20\text{ }^{\circ}\text{C}$
- (2) Fin surface temperature is $40\text{ }^{\circ}\text{C}$
- (3) Air inlet velocity is $u=1.5\text{ m/s}$, and $v=0$
- (4) Air outlet may be regarded as local one way condition
- (5) $l_1=2\text{ cm}$; $w=2\text{ mm}$; $p=1.5\text{--}2\text{ mm}$; $h=0.5p$; $\delta=0.2\text{ mm}$; l_2 and l_3 may be equal.

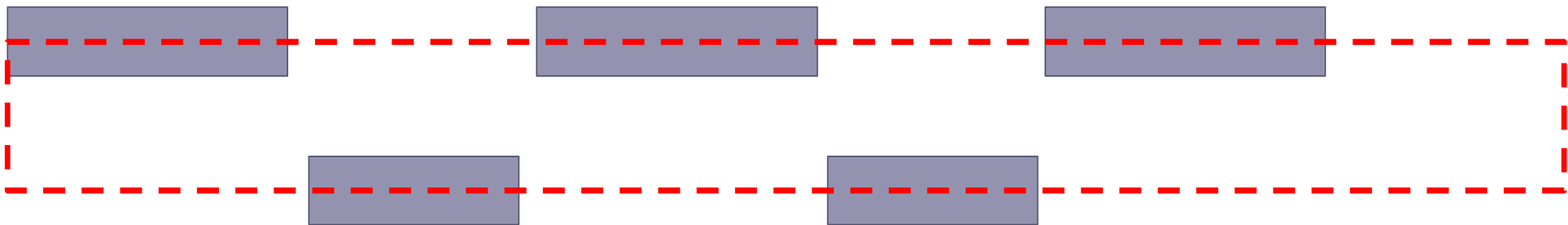


4. Find

- (1) The heat transfer rates of case (a) and case (b);
- (2) The pumping power of case (a) and case (b).

5. Suggestion

- (1) The computational domain of case (b) may be taken as follows, and is extended by several control volumes in flow direction in order to adopt the local one way outlet condition;



- (2) The pumping power can be determined by:

$$PP = \text{Air volume flow rate} \times \text{pressure drop}$$

6. Requirements

The project report should be written in the format of the Journal of Xi'an Jiaotong University. Both Chinese and English can be accepted.

Please submit in the USER part developed by yourself for solving the problem.

The project report should be due in before April 30, 2021 to room 1-6072 of Giant No.1.