
Week 9

Lecture 1
Project 2 is due Wednesday, November 5 at 11:30 AM;
Third makeup lecture: Thursday, November 6, 8:30 AM;
Midterms will be returned Thursday morning at end of lecture;
Discussion of 4th year elective courses; mechanical faculty (retired and new); some research topics.

Lecture 2
Convective heat transfer; a road map:
type of flow:
internal, external or combined internal and external flow
forced, natural or mixed convection
laminar, turbulent or transitional
developing or fully-developed internal flow
type of fluid
low Prandtl number fluids ($Pr << 1$) or high Prandtl number fluids ($Pr > 0.6$)
geometry
plates; cylinders (circular, square, etc), sphere, spheroids, cuboids, other geometries
boundary condition on wall
isothermal or isoflux
characteristic length of the system
$\mathcal{L}$; radius, diameter, hydraulic diameter: $D_h = 4A/P$, square root of active heat transfer area, $\mathcal{L} = \sqrt{A}$; some other geometric parameter or a combination of geometric parameters
local value at arbitrary point or area-average value

Dimensionless Numbers or Groups
Prandtl number: Pr; fluid parameter
Reynolds number: $Re_{\mathcal{L}}$; forced convection parameter
Grashof number: $Gr_{\mathcal{L}}$; natural convection parameter

Nusselt number: $Nu_{\mathcal{L}}$; heat transfer parameter
Peclet number: $Pe_{\mathcal{L}} = Re_{\mathcal{L}} Pr$; forced convection parameter
Rayleigh number: $Ra_{\mathcal{L}} = Gr_{\mathcal{L}} Pr$; natural convection parameter
Stanton number: $St_{\mathcal{L}} = Nu_{\mathcal{L}}/Pe_{\mathcal{L}} = Nu_{\mathcal{L}}/(Re_{\mathcal{L}} Pr$; heat transfer parameter
Graetz number: $Gz_D = (\pi/4) Re_D Pr (D/L)$; internal developing flow parameter
See Table 6.2 of Incropera and DeWitt for definitions of some dimensionless numbers.

Correlation equations

See summary of correlation equations on the ME 353 Web site and the text book.

Lecture 3

Third makeup lecture. Continue discussion of correlation equations: forced, external flow over isothermal sphere and circular cylinder. See text and summary of correlation equations on the Web.
Return Midterm Exams:
statistics:
Q1: min = 5, max = 10, mean = 8.77, std dev = 1.01
Q2: min = 3, max = 10, mean = 4.82, std dev = 2.29
Q3: min = 2, max = 10, mean = 7.67, std dev = 1.81
Exam: min = 14, max = 28, mean = 21.26, std dev = 4.82
