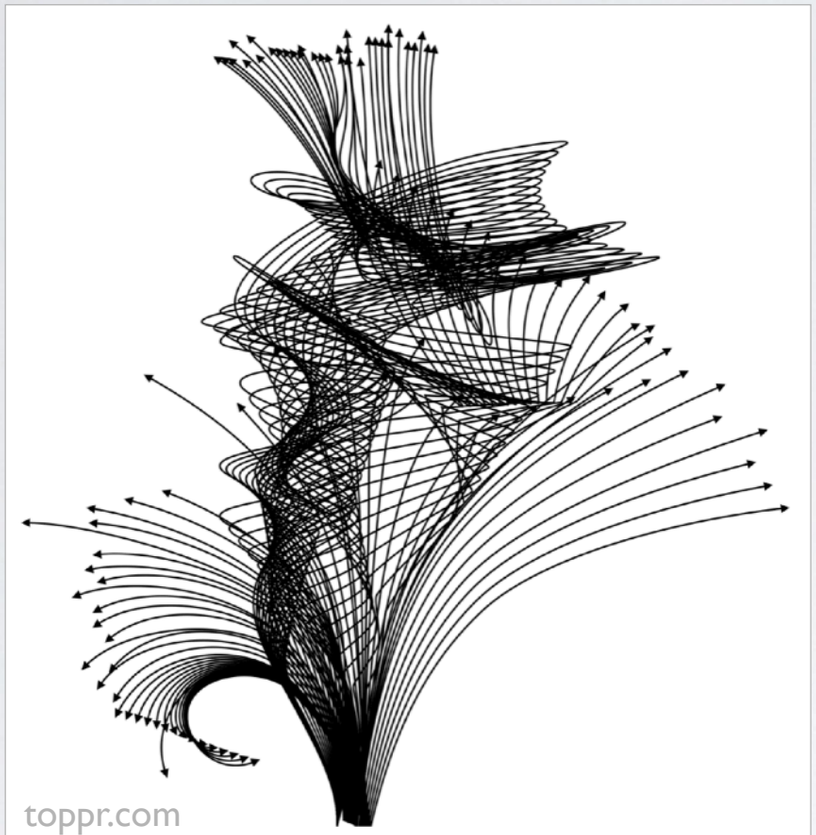
Week 10 - #2

Ordinary Differential Equations (II)



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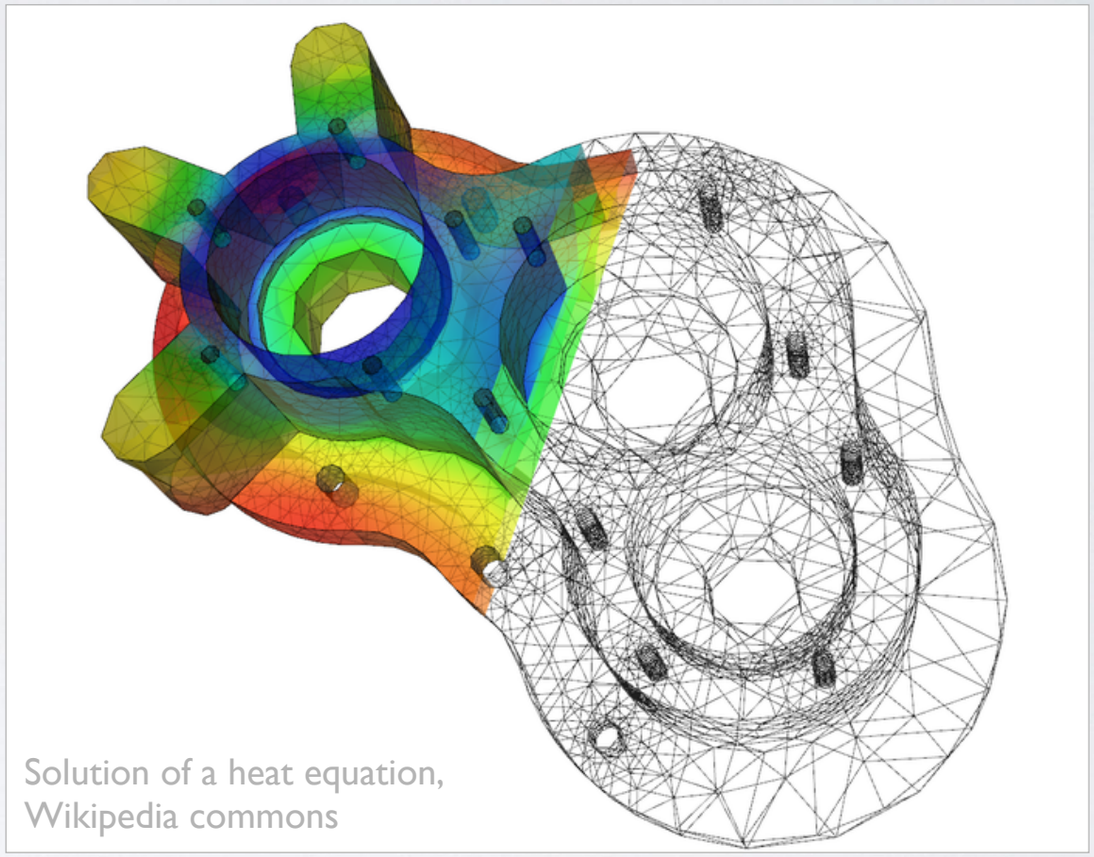


Solution of a heat equation,
Wikipedia commons

Today: Ch 8

Next Class: Ch 8

Ji-hoon Kim (Seoul National University)

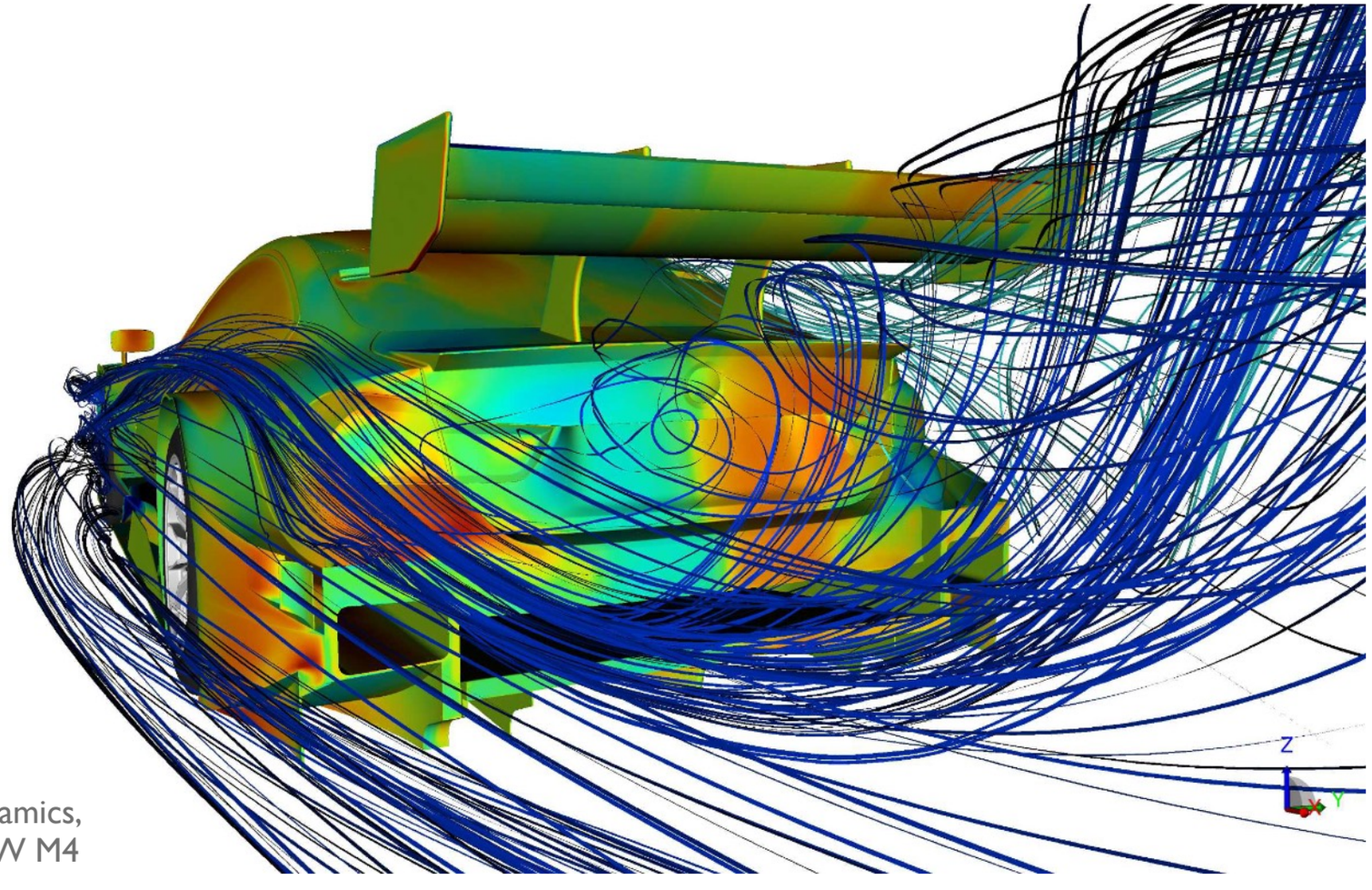
Rudimentary Mathematical Methods of Physics (Fall 2025): Quiz #15

— [open book and open note, but no cellphone or laptop, drop it off as you leave the class] —

Please write down your name and student ID in the top right corner. (0.0 pt: no paper found with your name / 0.5 pt: paper found with your name and some answers / 1.0 pt: good answers)

1. Boas, Chapter 8, Section 1, Problem 2

2. Boas, Chapter 8, Section 2, Problem 4 (after reviewing Eqs.(2.1)-(2.3) on separable equations)



Computational fluid dynamics,
BMW M4

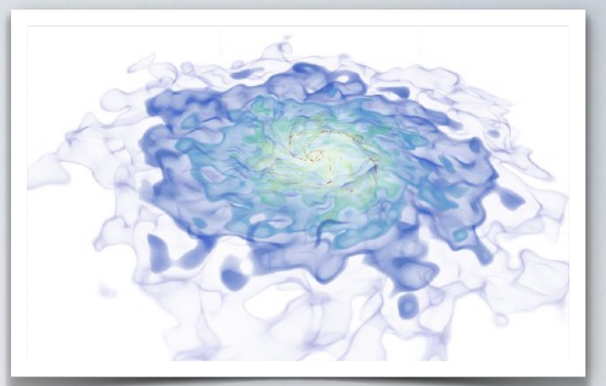
Rudimentary Mathematical Methods of Physics (Fall 2025): Suggested Problems in Chapter 8, Boas, 3rd ed.

The problems I suggest you to take a deeper look into include, but are not limited to, the following. The class homework assignments will mainly be from this list.

- Section 01: Problems 4
- Section 02: Problems 6, 8, 11, 12, 20(b), 34
- Section 03: Problems 4, 11, 14, 16, 20
- Section 04: Problems 2, 6, 8, 10, 15, 20
- Section 05: Problems 6, 9, 11, 13, 15, 24, 31(c)(d)
- Section 06: Problems 6, 8, 10, 14, 21, 23, 28, 34, 35, 42
- Section 07: Problems 2, 3, 8, 17, 22, 30
- Section 08: Problems 1, 2, 4, 7, 10, 11, 12, 19, 22, 26
- Section 09: Problems 8, 9, 14, 16, 28, 30, 34, 38
- Section 10: Problems 3, 8, 11, 14, 18
- Section 11: Problems 6(b)(c), 7, 9, 15, 21, 23, 25
- Section 12: Problems 2, 4, 6, 11, 16

<u>Chapter 13, Sections 1-4</u>

- Section 01: Problems 1, 4
- Section 02: Problems 1, 2, 3, 7
- Section 03: Problems 2, 3, 7
- Section 04: Problems 2, 5



Solving DE on WolframAlpha

Solving DE (Section 8.3, Example 1)

WolframAlpha computational intelligence

solve (1+x^2)y'+6xy=2x

NATURAL LANGUAGE | MATH INPUT | EXTENDED KEYBOARD | EXAMPLES | UPLOAD | RANDOM

Input interpretation

solve $(1+x^2)\,y'(x)+6\,x\,y(x)=2\,x$

Result

Step-by-step solution

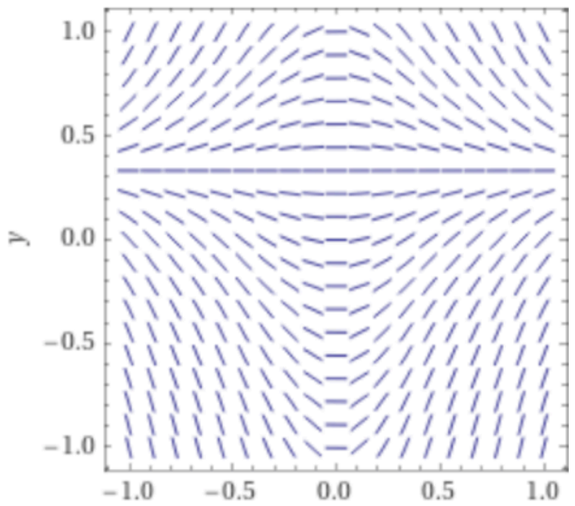
$$y(x)=\frac{c_1}{(x^2+1)^3}+\frac{x^2}{(x^2+1)^3}+\frac{x^6}{3\,(x^2+1)^3}+\frac{x^4}{(x^2+1)^3}$$

Separable equation

$$\frac{y'(x)}{2-6\,y(x)}=\frac{x}{1+x^2}$$

Slope field

Fewer points | More points | Slope field



Solving DE (Section 8.4, Problem 7)

WolframAlpha computational intelligence

solve x^2 dy + (y^2-xy)dx = 0

NATURAL LANGUAGE | MATH INPUT | EXTENDED KEYBOARD | EXAMPLES | UPLOAD | RANDOM

Input

$$x^2\,dy + (y^2 - x\,y)\,dx = 0$$

ODE names

Bernoulli's equation

$$y'(x) = \frac{y(x)}{x} - \frac{y(x)^2}{x^2}$$

Bernoulli's equation »

Homogeneous equation

$$y'(x) = -\frac{\left(-1 + \frac{y(x)}{x}\right) y(x)}{x}$$

Homogeneous equation »

ODE classification

first-order nonlinear ordinary differential equation

Differential equation solution — Step-by-step solution

$$y(x) = \frac{x}{c_1 + \log(x)}$$