MODELING WITH PDE
MA 4/561-1B, Spring 2020

Instructor: Dr. Y. Zeng, UH 4012, 934-2154, ynzeng@uab.edu

Time & Location: MWF, 9:05 a.m. – 9:55 a.m., HHB 221

Office Hours: MW, 2:30 p.m. – 3:30 p.m. (or by appointment)

Pre-requisite: MA252 (minimum grade C) or permission of instructor

Text: Lecture notes and assignments are posted on Canvas.

Grading Policy:

- MA 461:
  
  attendance
  (approximately weekly) written assignments/projects
  
  15 %
  85 %

- MA 561:
  attendance
  (approximately weekly) written assignments/projects
  a term project
  
  10 %
  75 %
  15 %

- Overdue assignments turned in before the last day of class receive half credits. No overdue assignments will be accepted after the last day of class.

- Your final grade is determined according to the following table:

<table>
<thead>
<tr>
<th>Course performance</th>
<th>88-100</th>
<th>75-87</th>
<th>62-74</th>
<th>50-61</th>
<th>below 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Grade</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
</tr>
</tbody>
</table>

Syllabus:

- Flocking: the Cucker-Smale model, flocking theorems, a flock of two birds, language evolution

- Synchronization: Peskin’s model for pacemaker cells (integrate-and-fire dynamics), the synchrony of two cells, Peskin’s conjectures, the Kuramoto model, phase-locked states

- Guitar/Violin Strings – Waves: equation, initial and boundary conditions
• Vibrating Membranes – The 2-D Wave Equation: a wave animation, musical and non-musical sounds

• Heat Flow: heat flow problem, the heat equation, initial and boundary conditions, steady state temperature distributions

• Diffusion: diffusion equation, population dynamics, space structured population dynamics, invasion fronts

• Introduction of Nonlinear Theory: weak solutions and elementary waves

• Traffic Flows: fundamental diagram of traffic flow, green light effect – rarefaction waves, red light effect – shock waves

Important dates:

• First day of class: January 13, 2020

• Martin Luther King, Jr. Holiday: January 20, 2020

• Last day to drop/add without paying full tuition: January 21, 2020

• Last day to withdraw with a “W”: March 13, 2020

• Spring Break: March 16 – 22, 2020

• Last day of class: April 24, 2020