A First Course on Kinetics and Reaction Engineering

Unit 27. Lesson Plan

Before Class

- Provide the redacted slides to the students and tell them to bring a printed copy of the slides to class

During Class

- Introduce today's topic and where it fits in the course (Slides 1 and 2)
- Review of Unit 27 (5 to 10 minutes)
  - Slide 3: go over the key concepts on the slides
    - Be sure to point out that, most generally, a momentum balance is also needed
- Ask whether the students have any questions from their pre-class preparation and answer them
  - Slide 4
- Learning Activity 27.1 (~15 minutes)
  - Slide 5: Read through the problem and take a vote whether there will be a step change front.
    - Ask someone who voted no to explain, then show slide 6
  - Slide 7: Give them ~5 minutes to write mole balances on A and R and an energy balance
  - Slides 8 and 9: Go over the results
    - Point out that the derivatives of volumetric flow and pressure are zero due to constant density and specification that pressure is constant; answer any questions
  - Slide 10: Give them a few minutes to write the initial conditions
  - Slide 11: Then go over results
  - Slide 12: Give them a few minutes to write the initial conditions
  - Slide 13: Then go over results
- Learning Activity 27.2 (~25 minutes)
  - Slide 14: Read through the problem and take a vote whether there will be a step change front.
    - Ask someone who voted yes to explain, then show slide 15
  - Slide 15: When most appear to be finished, or stuck, ask them what they found for initial and final values and then ask if anyone had trouble writing the equations needed to evaluate the functions. (If no one indicates any trouble, ask them what value of D should be used)
  - Slide 16: Show them the problem again and point out that now they need to plot T versus z at 11 minutes after the change
  - Slide 17: Use the slide to remind them what the plot will look like, then ask them when the front will break through
  - Slide 18: Give them a few minutes than ask how they would determine whether there has been breakthrough, show slide.

- Ask if there are questions, then ask where the front will be located and again give them a few minutes
  - Slide 19: Go over the answer; explain in more detail if necessary
  - Slide 20: Summarize how they would proceed from this point
  - Optional tell them to complete the problem as homework, giving them the remainder of class to get started.
- Slide 21: Put the material covered in this class into the overall context of the course.

After Class

- Provide the complete slides
- If they were told to complete the second activity as homework, give them the due date

Variations

- This lesson plan assumes you will not be asking students to solve PDEs numerically; it is used to provide some extra practice at solving steady state PFR problems. If you are going to ask your students to solve PDEs, you might want to change the in-class activities accordingly.