Syllabus for Math 7048 and 8048: Advanced Control Theory for Partial Differential Equations
Instructor: R.Triggiani, Dunn 329
Meeting time: TTH 2:40-4:05
The course will be offered on line for the whole semester.
(We need to be concerned about the many people, students etc, who will be passing through Dunn Hall every day)
The departmental webpage with detailed information about covid procedures is
https://www.memphis.edu/msci/news/covid.php
Office hours: video or telephone consultation available by appointment

PURPOSE.The purpose of the course is to introduce PhD students to research topics for their PhD thesis**.**
Accordingly, the class will discuss recent research papers on several areas of applications.
The mathematics involved is problem-based. Thus, very different mathematical techniques will be
introduced and exposed. For background, as needed, a basic text in Control Theory, is the text "Mathematical Control Theory", Birkhauser 2020 (second edition), by J Zabczyk. I already sent an
e-copy of this text to the entire class some weeks ago.

Topics to be covered include:

(i) fluid and fluid-thermal PDEs such as Navier-Stokes and Boussinesq systems:
well-posedness and uniform stabilization with localized boundary feedback control (3 weeks);

(ii) Unique Continuation properties critically needed in solving the stbilization problems in (i) (3 weeks);

(ii) fluid-structure interactions involving the linearized Navier-Stokes equations coupled at the interface
with a wave-type or plate-type PDE: well-posedness and control-theoretic properties with control acting
at the interface between the two domains (3 weeks);

(iii) third order (in time) PDEs arising in many applications: well-posedness and sharp interior and boundary regularity
with Dirichlet or Neumann boundary control. Inverse problems with boundary observation (3 weeks)

Written notes will be provided to the class for each topic.
Students will be expected to initiate original research in one of the areas presented.

Assignments and grade policy. Students will be asked to solve some problems either from Zabczyk's book
or more specifically related to the PDE-topics. At the end of the semester, each student will make

a zoom presentation
on a topic of interest selected in consultation with the instructor.