



università
degli studi di bari
ALDO MORO

**dipartimento
di matematica**

il direttore

Seminari di Matematica

Nell'ambito delle attività di Visiting Professor
del Dipartimento di Matematica,
docente referente la Prof.ssa Genni Fragnelli,

la Professoressa **Gisèle Ruiz GOLDSTEIN**

University of Memphis, USA

terrà in modalità mista presso il Dipartimento di Matematica
dell'Università degli Studi di Bari Aldo Moro e via Microsoft Teams,
la seguente conferenza:

Boundary Conditions in Science

il giorno **25 Giugno 2021** dalle ore **15:00** alle ore **17:00** in **Aula XI**
e su Microsoft Teams codice **83lvjdk**

La S.V. è cordialmente invitata a partecipare.

Bari, 18/06/2021

Il Direttore del Dipartimento di Matematica
F.to Prof.ssa Addolorata SALVATORE

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Boundary Conditions in Science

Gisèle Ruiz Goldstein

Abstract

The study of partial differential equations with Dirichlet, Neumann and Robin boundary conditions goes back nearly 200 years. But, remarkably, it is only in past few decades that more accurate descriptions of physical boundary conditions have been considered.

In this lecture, we will derive and discuss dynamic boundary conditions for the heat equation, wave equation and the Cahn-Hilliard equation.

For the heat equation such boundary conditions model a heat source on the boundary. In this case a derivation will be given in which the boundary conditions arise naturally in the formulation of the problem. We will discuss the mathematical model, the relevant spaces and qualitative as well as quantitative properties of the solution of the model.

For the wave equation, dynamic boundary conditions arise from incorporating the effects of kinetic energy and potential energy on the boundary as well as inside the region. A derivation via classical methods of the calculus of variations and the physical interpretation of the kinetic boundary conditions will be given. All of the standard boundary conditions (Dirichlet, Neumann, and Robin) will be obtained as special cases of the kinetic boundary conditions.

Connections between kinetic and general Wentzell boundary conditions will be discussed. Recent results in the theory of initial-boundary value problems with dynamic boundary conditions will be presented. We shall show that the problems are well-posed in a certain spaces and present results.

Finally, we discuss the problem of phase separation for a binary mixture in a domain with nonpermeable walls in the context of the Cahn-Hilliard model. The nonpermeability of the boundary leads to consideration of a novel boundary condition for the chemical potential. Dynamic boundary conditions for the relative concentration are considered. The derivation of the model as well as a discussion of the solution of this problem will be presented.