Abstract: We present a model order reduction approach for a class of nonlinear diffusion PDEs via a physically constrained CNN. The architecture of this network is motivated by classical approximation technique, e.g. matrix Chebyshev series, and requires the minimal number of training samples. We perform experiments to demonstrate that the dependence between the initial state of the system and the final state at a given moment of time can be well approximated by our ROM.

15:00-15:30

Data-driven identification of dissipative dynamics

Christopher Beattie   Christopher Beattie
Abstract: Computational models of physical systems should take into account the manner in which systems handle energy flux, but this can be a significant challenge when models are derived directly from response data in the absence of ancillary knowledge of internal dynamics. A data-driven modeling framework is introduced that can yield either a convex family of passive/dissipative models consistent with observed response profiles or a minimal perturbation to data that is consistent with such models.

15:30-16:00

Enhanced Magnetic Resonance Imaging Based on High-Permittivity Pad Optimization

Rob Remis   Delft University of Technology
Jeroen Van Gemert   Delft University of Technology
Wyger Brink   Leiden University Medical Center
Andrew Webb   Leiden University Medical Center
Abstract: In high-field magnetic resonance imaging (MRI), destructive and constructive interference effects may degrade the quality of an MR image to such an extent that it can no longer be used for diagnostic purposes. Properly designed high-permittivity pads offer an affordable solution to this problem and in this contribution, we describe a reduced-order modeling optimization technique for their design. The effectiveness of the pads is illustrated for brain scans acquired at seven tesla.

16:00-16:30

A discrete elasticity inverse problem

Fernando Guevara Vasquez   The University of Utah
Abstract: We consider the inverse problem of finding the Lamé parameters of an elastic medium from measurements of displacements and forces at the boundary. We report preliminary results on a numerical method for solving the problem and that consists of first finding a triangulation on which the problem for reference Lamé coefficients can be easily solved and using this triangulation for reconstructions for general Lamé parameters.

MS A6-2-3 6   **14:30-16:30**

Mathematics Education

Organizer: Marta Peña Carrera   Universitat Politècnica de Catalunya
Organizer: Cristina Solares   University of Castilla-La Mancha
Abstract: It is well known that in order to achieve greater motivation and engagement of students, it is convenient to contextualize the sciences, in our case, mathematics, through immediate applications to the disciplines of the career. The students must participate actively in the construction of their knowledge and the introduction of realistic applications is helpful for providing meaning to knowledge. The scope of this minisymposium is to illustrate through applications, which can be solved also using computing software, how mathematics can be explained.

14:30-15:00

Contextualization of mathematics subjects in engineering studies

Marta Peña Carrera   Universitat Politècnica de Catalunya
María Teresa López Díaz   Universitat Politècnica de Catalunya
Abstract: It is well known that in order to achieve greater motivation and use of students, it is useful to contextualize the sciences (mathematics, ...) through immediate applications to the disciplines of the career. For example, matrix modeling engineering problems and then applying matrix calculation techniques for study and resolution. The objective of this work is the improvement of the teaching of mathematics in engineering studies, illustrating teaching of these through different technological problems.

15:00-15:30

Teaching of calculus concepts under problem solving perspective

Cristina Solares Martínez   Universidad de Castilla-La Mancha
Henar Herrero Sanz   Universidad de Castilla-La Mancha
Mª Del Rocío Blanco Somolinos   Universidad de Castilla-La Mancha
Abstract: In this study we propose to introduce the concepts of derivative and integral starting from applied contexts, providing to the students problems related to their studies. The teacher presents different questions to guide the students in the construction of their knowledge. Students participate actively and the new concepts involved become meaningful for them.

15:30-16:00

Learning mathematics: the role of the mathematical modeling

Carmen Coll Aliaga   Universitat Politècnica de València
Elena Sánchez   Universitat Politècnica de Valeència
Abstract: In this talk, it is analyzed how the introduction of mathematical models increases students' interest in a specific Mathematics subject and how these models can help students understand and develop mathematical concepts. In particular, some examples of epidemic models are given and emphasis is placed on the important role of knowledge of Algebra, differential equations or equations in differences in the study of these models.

16:00-16:30

Constructing probability problems

Marlén Alonso Castaño   Campus of Llamaquique
Pedro Alonso   University of Oviedo
Laura Muñiz-Rodríguez   University of Oviedo
Luis José Rodríguez-Muñiz   University of Oviedo
Abstract: Problem-solving is a fundamental aspect in mathematical thinking development. In this study, we focus on the creation of probability problems formulated by prospective teachers. Our objective is to identify how they use their mathematical and pedagogical knowledge in the creation of these problems. We observed that students provide few explanations to justify the problem adequacy to the level requested. This leads us to think that we should emphasize these aspects to improve their training.

MS FT-0-3 6   **14:30-16:30**

Numerical Approximations of Geometric Partial Differential Equations   - Part 4

Organizer: Alan Demlow   Texas A&M University
Organizer: Andrea Bonito   Texas A&M University
Organizer: Ricardo Nochetto   University of Maryland
Abstract: Geometric partial differential equations have received much attention recently due to their appearance in models for a wide range of physical processes. This mini-symposium focuses on their numerical approximation, which must overcome highly nonlinear interactions inherent to the approximation of partial differential equations defined on approximate geometries. Experts in modeling, numerical analysis, and scientific computation will discuss recent advances ranging from fundamental considerations concerning the design and analysis of numerical methods to applications in biology, materials science, and fluid dynamics.

14:30-15:00

Finite element approximation of an obstacle problem for a class of integro-differential operator

Abner Salgado   University of Tennessee at Knoxville
Abstract: We study the regularity of the solution to an obstacle problem for a class of integro-differential operators. The differential part is a second order elliptic operator, whereas the nonlocal part is given by the integral fractional Laplacian. The obtained smoothness is then used to design and analyze a finite element scheme.

15:00-15:30

Discontinuous skeletal methods for the elliptic obstacle problem

Thirupathi Gudi   Indian Institute of Science Bangalore