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 techniques, 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  
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  
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  
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.

14:30-16:30

MS A6-2-3 6
Mathematics Education  
Organizer: Marta Peña Carrera
Organizer: Cristina Solares
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  
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  
University of Castilla-La Mancha  
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  
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.

14:30-16:30

Numerical Approximations of Geometric Partial Differential Equations - Part 4  
For Part 1 see: MS FT-0-3 0  
For Part 2 see: MS FT-0-3 4  
For Part 3 see: MS FT-0-3 6  
For Part 4 see: MS FT-0-3 8  
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-differentila 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.