Seminar of the Chair of Optimization and Control
under prof. Stanisław Migórski
winter semester 2022-2023, Thursday, 10:15-11:45

October 6, 2022
Anna Ochal, Asymptotic behavior of solutions to a class of elliptic boundary hemivariational inequalities

ABSTRACT: First, steady-state heat conduction problems with mixed boundary conditions are considered. We recall the monotonicity property and asymptotic behavior of solutions when the heat transfer coefficient tends to infinity. Next, the problem is generalized to one with multivalued nonmonotone subdifferential boundary conditions on a portion of the boundary, and the results analogous to the classical ones are obtained. Finally, some examples of nonconvex potentials are presented.

The talk is based on the paper by C.M. Gariboldi, S. Migórski, A. Ochal, D.A. Tarzia, Existence, Comparison, and Convergence Results for a Class of Elliptic Hemivariational Inequalities, Applied Mathematics & Optimization 2021, doi: 10.1007/s00245-021-09800-9.

October 13, 20, 2022
Anna Ochal, The Stefan problem: an introduction

ABSTRACT: We consider the process of diffusion of heat in a medium accompanied by a change of phase state. We present the formulations of some classical Stefan problems as variational inequalities.

The talk is based on the book of S.G. Gupta, The Classical Stefan Problem (https://doi.org/10.1016/C2017-0-02306-6).

October 27, November 4, 2022
Dong-ling Cai, Convergence results for a class of multivalued variational–hemivariational inequality

ABSTRACT: We focus on a class of multivalued variational–hemivariational inequalities with pseudomonotone operator and constraint set in Hilbert spaces. By employing the penalty method and the Moreau–Yosida approximation technique, we construct an approximating problem for the original multivalued variational–hemivariational inequality under consideration. The main result in the paper shows that every weak cluster of the solution sequence for the approximating problem is always a solution of the original problem. Moreover, based on the obtained weak convergence result, another two strong convergence results are obtained when the condition of pseudomonotonicity is reinforced. Finally, we illustrate the application of our abstract results in the study of a frictionless contact problem in mechanics

with unilateral constraint.

The talk is based on a paper with the same title by Dong-ling Cai and Yi-bin Xiao, Communications in Nonlinear Science and Numerical Simulation 103 (2021) 106026 (https://doi.org/10.1016/j.cnsns.2021.106026).

November 10, 17, 2022
Jan Słaboń, Fluid Flow in Porous Media by a Mixed Method

ABSTRACT: Wide category of mathematical models can be stated in the form of free boundary problems, one of such models describes fluid flow through earthen dam. During seminar we will focus on derivation of the problem and its weak form, we are going to show the existence of solution to slightly simplified problem.

The talk is based on I. Athanasopoulos, G. Makrakis and J.F. Rodrigues (Eds), Free boundary problems : theory and applications, Chapman & Hall/CRC, 1999.

November 24, December 1, 2022
Anna Kulig, A frictional contact problem for an electro-viscoelastic body

ABSTRACT: We study a mathematical model which describes the quasistatic frictional contact between a piezoelectric body and a deformable conductive foundation. A nonlinear electro-viscoelastic constitutive law is used to model the piezoelectric material. Contact is described with the normal compliance condition, a version of Coulomb law of dry friction, and a regularized electrical conductivity condition. A variational formulation of the model, in the form of a coupled system for displacements and electric potential, is derived. The existence of a unique weak solution of the model is established under a smallness assumption on the surface conductance. The proof is based on arguments of evolutionary variational inequalities and fixed points of operators.

The talk is based on the paper of Z. Lerguet, M. Shillor, M. Sofonea (2007).

December 8, 2022
Dominika Wilczyńska, An optimal control model for a two-person game

ABSTRACT: We introduce a model for two-person, zero-sum differential game, which main idea is that two players control the dynamics of some evolving system and one of them wants to maximize, while the other wants to minimize the payoff functional. We want to find an optimal strategy for each player.

The talk is based on: C. Evans, "An Introduction to Mathematical Optimal Control Theory Version 0.2", rozdział 6: "Game theory".

December 15, 2022
Justyna Porzycka, Arrow's theorem via ultrafilters

ABSTRACT: Arrow's theorem on voting systems states that any voting system that decides between three or more candidates and that satisfies certain assumptions (present in many voting systems) must be dictatorial (as long as the number of voters is finite). A proof of this theorem using ultrafilters will be presented.

The talk is based on Sebastien Vasey, "Arrow's impossibility theorem and ultrafilters", Neil Hindman, Dona Strauss, "Algebra in the Stone-Cech Compactification: Theory and Applications", chapter 3.

January 12, 2023
Wiktor Prządka, Structural optimization using sensitivity analysis and a level-set method

ABSTRACT: In the talk we focus on the optimization of elastic structures by a level-set method and shape derivatives. We will present a general idea of the problem with the algorithm, using a compliance minimization problem as an example.

The talk is based on a paper by Grégoire Allaire, François Jouve and Anca-Maria Toader with the same title, Journal of Computational Physics, 194 (2004) 363-393 (https://doi.org/10.1016/j.jcp.2003.09.03).

January 19, 2023
Paweł Goliszewski, Modelling, Analysis and Numerical Simulation of a Spring-Rods System with Unilateral Constraints

ABSTRACT: During this seminar we will present a Spring-Rods System with Unilateral Constraints. It is one-dimensonal model where two elastic rods are connected by spring with contact condition. We present a strong formuation and derivation of the variational formulation of the model which is in a form of an elliptic quasivariational inequality for the displacement field. Under additional condition for the spring strain-stress relation the weak form can be lead to variational inequality. It can be easily solved numerically in finite element space. Some computational results will be shown. The project was made under the CONMECH grant. Details are described in paper "Modelling, Analysis and Numerical Simulation of a Spring-Rods System with Unilateral Constraints" which is under preparation.

January 26, 2023
Piotr Bartman, Duality Arguments in the Analysis of a Viscoelastic Contact Problem

ABSTRACT: I will talk about our work in progress analysis of a contact problem which describes the quasistatic frictionless contact of a viscoelastic body with a rigid-plastic foundation. I will start with problem motivation and then provide three different variational formulations of the model in which the unknowns are the displacement field, the stress field and the strain field, respectively. These formulations have a different structure. Nevertheless, I will prove that they are pairwise dual of each other and then deduce the unique weak solvability of the contact problem as

well as the Lipschitz continuity of its weak solution with respect to the data. The proofs are based on recent results on history-dependent variational inequalities and inclusions.