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ON A CLASS OF ABSTRACT FOURTH-ORDER DIFFERENTIAL EQUATION SET ON A PARTICULAR CUSP DOMAIN

B. Chaouchi[1,*], L.Benaissa[2], M. Kostić[3]; H.C.Koyuncuoğlu [4] and W. S. Du[5]

[1]National Higher School of Cybersecurity, Mahelma 16093, Algiers, Algeria

[*]LESI, Khemis Miliana University, Khemis Miliana, 44225, Algeria.
[2]Department of Mathematics, Faculty of Science, University of Algiers, Algiers, Algeria
[3] University of Novi Sad, Trg D. Obradovića 6, 21125, Novi Sad, Serbia
[4]Department of Engineering Sciences, Izmir Katip Celebi University, 35620,Izmir, Turkey
[5]Department of Mathematics,National Kaohsiung Normal University, Kaohsiung, Taiwan

Abstract. In this work, we concentrate on a boundary value problem set on a singular domain containing a cuspidial point. In our study, we obtained some existence and maximal regularity results. Our strategy is based on the study of a boundary value problems for a class of an abstract fourth-order differential equations with the use of the fractional powers of unbounded linear operators.

Keywords. Cusp domains, Abstract differential equations, Hilbert spaces, Sobolev spaces, fractional powers of operators

AMS (MOS) subject classification: 34G10, 34K10, 44A45, 47D06, 47G20

1 Origin of the Problem and Motivation

Boundary value problems posed on singular or irregular domains continue to attract considerable attention due to both their mathematical complexity and their relevance in modeling diverse physical processes. Singular geometries such as cusps naturally arise in several applied contexts, and therefore understanding the solvability and regularity of partial differential equations on such domains remains of great interest. Numerous contributions addressing these issues can be found in [1, 17, 22, 23, 25, 29] and the references therein. Among higher order partial differential equations, biharmonic equations play a particularly prominent role. Theyappear in a wide range of applications including thin plate theory, phase field models for multiphase systems, interface motion, image processing, and flows in Hele–Shaw cells. Furthermore, many problems from elasticity theory can be reformulated as biharmonic equations equipped with physically motivated boundary conditions. As a result, biharmonic problems have been studied using analytical, numerical, and functional analytic approaches;see, for example, [3, 28]. We