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BOUNDARY STABILIZATION OF TWO-DIMENSIONAL PETROVSKY EQUATION: VIBRATING PLATE

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Abstract. The two-dimensional Petrovsky equation modelled from a vibrating elastic plate with dynamical force and moment control on the boundary is formulated as an abstract evolutionary equation via the Friedrichs extension of the coupled symmetric and accretive differential operator. The approach of infinite dimensional LaSalle's invariance principle and the spectrum analysis is taken to prove the strong stabilization of the whole system in the energy space by a linear boundary damping feedback.

1. Physical setting and mathematical model. The transversal vibration of plate is governed by the two-dimensional Petrovsky equation. Since the well-posed boundary conditions are more complicated than the boundary conditions associated with two-dimensional wave equation, the published results are relatively few. However, there are still some research efforts devoted to the controllability and stabilization issues with "static" boundary control; i.e., no boundary differential equations involved, cf. [1], [2]. The results of optimal control are also provided in [3] and [4].

As a generalization of the hybrid system associated with large space structures such as elastic beams, the dynamical boundary control of plate systems which involves boundary differential equations will be investigated in this paper by the approach of infinite dimensional LaSalle invariance principle and spectrum analysis.

We shall study stabilization and controllability problems of a vibrating isotropic plate on a rectangular bounded region with edging-mass and force-moment dynamics along one edge, starting from its mathematical model. The related concepts of plate elasticity can be found in [5] and [6].

Consider an isotropic rectangular plate system defined on $\Omega = [0,1] \times [0,1]$ with the boundary $\Gamma = \bigcup_{i=0}^{3} \Gamma_i$, where

$$\Gamma_0 = \{(x,y) \in \Gamma : x = 0\}, \quad \Gamma_1 = \{(x,y) \in \Gamma : y = 0\},$$
$$\Gamma_2 = \{(x,y) \in \Gamma : x = 1\}, \quad \Gamma_3 = \{(x,y) \in \Gamma : y = 1\}.$$

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