SUMMARY OF DOCTORAL THESIS

The author's name: Nguyen Xuan Tu

Thesis title: Long time behavior and control problem for some classes of strongly degenerate parabolic equations

Scientific branch of the thesis: Mathematics

Major: Mathematical analysis   **Code:** 9 46 01 02

The name of postgraduate training institution: Hanoi Pedagogical University N2

1. Thesis purpose and objectives

- *Objectives of this thesis:* To study existence, long-time behavior of solutions and control problem for some classes of strongly degenerate parabolic equations by using the methods of Functional Analysis.

- *Subjects of this thesis:* The existence, long-time behavior of solutions and control problem for some classes of strongly degenerate parabolic equations.

2. Research methods

- *To study the existence of solutions*: Using Galerkin approximation, the compactness and energy methods.

- *To study the existence attractors:* Using the methods of infinite dimensional dissipative dynamical systems theory.

- *In order to study the controllability of the linear problem:* Using the Hilbert Uniqueness Method (HUM).

3. Major results and conclusions

3.1. The major results

- Proving the existence and uniqueness of the weak solution, the existence of a global attractor for a class of semilinear parabolic equation involving the strongly degenerate operator Δ_λ on the bounded domain.

- Proving the existence and uniqueness of the weak solution, the existence of the global attractors for a class of semilinear parabolic equation involving the strongly degenerate operator $P_{s,\gamma}$ on $\mathbb{R}^N$.

- For the parabolic equation involving the strongly degenerate operator $P_{s,\gamma}$ in multi-dimensional case: We proved that the null controllability in any time $T > 0$ holds when $s + \gamma \in \left(0, \dfrac{1}{2}\right)$ (weak degeneracy). When $s = \gamma = \dfrac{1}{2}$ (strong degeneracy), we proved that the null controllability holds in large time. We have proved the null controllability in any time $T > 0$ when $s + \gamma > 1$ (too strong degeneracy).

3.2. Conclusions

    - The content of this thesis fits the major.

    - The results presented in this thesis are new.

    - Further research directions:

        + Study the properties of the global attractor obtained in Chapters 2 and 3, such as studying the smoothness of the attractor, evaluating the number of fractal dimensions, the continuous dependence on the parameter,...

        + Study the existence and uniqueness of the weak solution, the existence of a global attractor for a class of semilinear parabolic equation involving the strongly degenerate operator Δ_λ on $\mathbb{R}^N$.

        + Study the null controllability in the remaining cases of s and γ: Is it null controllable when $s + \gamma \in \left(\dfrac{1}{2}; 1\right)$? Is it null controllable at large enough time, not null controllable at small time, when $s + \gamma = 1,\ s, \gamma \neq \dfrac{1}{2}$?

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<tr><td align="center">On behalf of academic supervisors</td><td align="center">PhD. Student</td></tr>
<tr><td align="center">PhD. Tran Van Bang</td><td align="center">Nguyen Xuan Tu</td></tr>
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