

Exploring Regularity Results in the Context of Extremely Degenerate Elliptic Equations

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Abstract : This research endeavors to explore the regularity properties associated with a specific class of equations, namely extremely degenerate elliptic equations. These equations hold significance in understanding complex physical systems like porous media flow, with applications spanning various branches of mathematics. The focus is on unraveling and analyzing regularity results to gain insights into the smoothness of solutions for these highly degenerate equations. Elliptic equations, fundamental in expressing and understanding diverse physical phenomena through partial differential equations (PDEs), are particularly adept at modeling steady-state and equilibrium behaviors. However, within the realm of elliptic equations, the subset of extremely degenerate cases presents a level of complexity that challenges traditional analytical methods, necessitating a deeper exploration of mathematical theory. While elliptic equations are celebrated for their versatility in capturing smooth and continuous behaviors across different disciplines, the introduction of degeneracy adds a layer of intricacy. Extremely degenerate elliptic equations are characterized by coefficients approaching singular behavior, posing non-trivial challenges in establishing classical solutions. Still, the exploration of extremely degenerate cases remains uncharted territory, requiring a profound understanding of mathematical structures and their implications. The motivation behind this research lies in addressing gaps in the current understanding of regularity properties within solutions to extremely degenerate elliptic equations. The study of extreme degeneracy is prompted by its prevalence in real-world applications, where physical phenomena often exhibit characteristics defying conventional mathematical modeling. Whether examining porous media flow or highly anisotropic materials, comprehending the regularity of solutions becomes crucial. Through this research, the aim is to contribute not only to the theoretical foundations of mathematics but also to the practical applicability of mathematical models in diverse scientific fields.

Keywords : elliptic equations, extremely degenerate, regularity results, partial differential equations, mathematical modeling, porous media flow

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