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Foreword

Special issue on degenerate and singular PDEs and phenomena in analysis and mathematical physics

The study of degenerate and/or singular partial differential equations has been an extremely active research topic during the past few years. Nonlinear elliptic, parabolic or hyperbolic equations often may have vanishing coefficients or small parameters in higher order partial derivatives, causing a change in types of PDEs, singular concentration behaviors or blowup of solutions. In addition, singularities in the geometry of the domain and/or terms in the PDEs lead to significant complexities of analysis, yielding still more unusual phenomena or patterns of solutions. Such degenerate or singular partial differential equations arise naturally, and they have occupied a central role in the interdisciplinary research between analysis, geometry, biology, elasticity, mathematical physics, etc. We can see an immense breadth of mathematics and its beauty in the works of this research.

To highlight the importance of this area, to present the state-of-the art of the theory and techniques, and with a further aim to attract more attention from the JMAA contributors and readerships alike, we put together this special issue by leading researchers. Overall, there are 38 research papers or surveys. The topics covered include the following:

- Measure-valued solutions and the phenomenon of blow-down in logarithmic diffusion
- Ground state solutions of quasilinear elliptic equations
- Singular solutions with boundary blow-up solutions for logistic-type equations
- Nonlinear equations on fractal blowups
- Nonhomogeneous degenerate differential operators with applications to harmonic analysis
- Free boundary solutions for singular quasilinear elliptic problems
- Lagrangian approach to the study of level sets and applications to climatology
- Very weak solutions with boundary singularities for nonlinear equations with conical corners
- Sobolev-type inequalities for degenerate differential operators
- Nonlinear PDEs with singular terms
- Asymptotic stability for anisotropic Kirchhoff systems
- Boundary regularity for viscosity solutions to degenerate elliptic PDEs
- Ill-posed minimization problems in image processing
- Perturbation results, singular limits and well-posedness
- Blow-up solutions of Schrödinger equations with oscillating nonlinearities
- Optimization problems for energy functionals with mass constraint

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