ABSTRACTS

Existence results of positive solutions for the radial p-Laplacean

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We study the existence of positive solutions of the following nonlinear equation $\frac{1}{A}(A\Phi_p(u'))' = -\varphi(.,u)$, in $(0,\omega)$, where $p > 1$, $\omega \in (0,\infty]$, $\Phi_p(x) = x\,|x|^{p-2}$ and A is a regular function. Our purpose is to give two existence results for the above equation subject to some boundary conditions, where the nonlinear term φ is a nonnegative continuous function in $[0,\omega) \times (0,\infty)$, satisfying some appropriate conditions.

Boundary value problems for complex model equations

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Integral representation formulas are often improper to solve boundary value problems. Therefore such representations have to be modified. A well know example is the Cauchy formula for analytic functions in connection with the Dirichlet problem. A modification leads to the Schwarz formula providing a solution to the Schwarz problem. This Schwarz representation generalizes nicely and smoothly to a representation for solutions to the inhomogeneous poly-analytic equation in the unit disc of the complex plane. In order to create a general theory of complex partial differential equations in a first step model equations are treated. A model equation is a differential equation consisting only of the main part of the differential operator. In complex analysis it is thus a product of powers of the Cauchy-Riemann operator and its complex conjugate. Particular cases are the Poisson equation, the Bitsadze equation, inhomogeneous poly-analytic and poly-harmonic equations. For these equations boundary value problems of Schwarz, of Dirichlet, of Neumann, of Robin type and of combinations of these are investigated. In order to get solutions and solvability conditions in explicit forms the particular case of the unit disc is studied. Half and quarter planes are other particular domains where explicit solutions are available.

Boundary value problems for complex model equations

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For the Laplace operator Dirichlet and Neumann problems are well studied and harmonic Green and Neumann functions are widely known. A biharmonic Green function is also used occasionally. But for the bilaplacian there are different possibilities to determine Green functions. There are biharmonic Green, Neumann and Robin functions but there are also hybrid Green functions. They are asymmetric functions behaving like Green, Neumann, or Robin functions in one variable and like one of them, not necessarily the same, in the other. There exist related different basic boundary value problems for the biharmonic equation which can be solved explicitly e.g. in the unit disc provided proper solvability conditions are satisfied. The situation is more complicated for the poly-harmonic operator. Here three kind of boundary value problems are considered, two different Dirichet problems and one Neumann boundary value problem.

On a singular value problem for the fractional Laplacean on the exterior of the unit ball

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We study a singular value problem and the boundary Harnack principle for the fractional Laplacean on the exterior of the unit ball.

Feller processes with fast explosion

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Let X be a doubly Feller irreducible process satisfying the condition $U^1 1 \in \mathcal{C}_0(E)$, where $(E, \mathcal{E})$ is the state space of the process and $(U^\alpha)_{\alpha \geq 0}$ the resolvent associated with X. This condition turns out to express the fast explosion of the process. We show that the exponential decay parameter λ associated with X as irreducible process coincides with λ_0, the spectral radius of the semigroup on $\mathrm{b}\mathcal{E}$ and that X is λ_0-positively recurrent. Consequences of this property on the long term behaviour of X as well as particular cases of interet are discussed. The main underlying facts are the existence of a λ_0-invariant probability (proved in [1]) and the fact taht $U^1$is an ∞-uniformly integrable operator (in the sense of [2]).

References

[1] S. Sato. An inequality for the spectral radius of Markov processes. *Kodai Math.J.,* **8** (1985) 5-13.

[2] L. M. Wu. Uniformly Integrable Operators and Large Deviations for Markov Processes. *J. Funct. Anal.* **172** (2000) 301-376.

The influence of singular potentials in elliptic equations of Lane-Emden-Fowler type

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We present existence, regularity and bifurcation for positive classical solutions of the general elliptic equation

$$-\Delta u \pm p(d(x))g(u) = \lambda f(x,u) + \mu|\nabla u|^a$$

in a smooth domain Ω, subject to homogeneous Dirichlet boundary condition. Here $d(x) = \mathrm{dist}(x, \partial\Omega)$ and λ, μ, a are real parameters in the range $\lambda > 0$, $\mu \in \mathbb{R}$, $0 < a \leq 2$. It is assumed that f is a nonnegative and nondecreasing function, $p(d(x))$ is a positive potential with singular behavior on the boundary and that the nonlinearity g is unbounded around the origin. We emphasize the role played by the singular potential $p(d(x))$, the convection term $|\nabla u|^a$, and the singular nonlinearity g in the study of positive classical solutions.

Our approach rely on the sub- and super-solution method combined with an adapted maximum principle for singular elliptic equations.