Seminário de Análise

PDE with operator that is not linear and nonhomogeneous and sub-supersolution method

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Abstract. The classical method of sub-supersolution asserts that if we can find sub-supersolution $v_1, v_2 \in H_0^1(\Omega)$ with $v_1(x) \le v_2(x)$ a.e. in Ω, then there exists a solution $v \in H_0^1(\Omega)$ such that $v_1(x) \le v(x) \le v_2(x)$ a.e. in Ω.

In general, a candidate to subsolution of problem is given by $v_1 = \epsilon\phi_1$, where ϕ_1 is a eigenfunction associate a λ_1, the first eigenvalue of the operator $(-\Delta, H_0^1(\Omega))$. A candidate to supersolution, in general, is the unique positive solution of the problem

$$\begin{cases} -\Delta e = M \text{ in } \Omega, \\ u > 0 \text{ in } \Omega, \\ u \in H_0^1(\Omega), \\ u = 0 \text{ on } \partial\Omega. \end{cases}$$

The size of ϵ and the size of the constant M, together with Comparison Principle to the operator $(-\Delta, H_0^1(\Omega))$, allow to show that the sub-supersolution are ordered.

If the operator is not linear and nonhomogeneous, in general we do not have eigenvalues and eigenfunctions. However, in this case, we show that the sub-supersolution method still can be applied.

References

[1] Suellen C. Q. Arruda, Giovany M. Figueiredo and Rubia G. Nascimento, Existence and multiplicity of positive solutions for a singular $p\&q$-Laplacian problem via sub-supersolution method, preprint, 2018.

[2] Gelson C. G. dos Santos, Giovany M. Figueiredo and Julio R. S. Silva, Multiplicity of positive solutions for a anisotropic problem via Sub-supersolution method and Mountain Pass Theorem, preprint 2018.