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A Short Note on Semilinear Elliptic Equations in Unbounded Domain

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Abstract: Let $\Omega \subset \mathbb{R}^n$ be a domain (not necessarily bounded) with smooth boundary $\partial\Omega$. Let $1 \leq n \leq 6$ and $f \in C^{0,\alpha}(\overline{\Omega}) \cap L^2(\Omega)$ be a given function with $f < 0$. In the present study, we prove that the following BVP

$$-\Delta u = u^2 + f \quad \text{in } \Omega, \quad u = 0 \quad \text{on } \partial\Omega,$$

has a solution $u \in H_0^1(\Omega)$ and satisfies $u \leq 0$ in Ω.

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