The probabilistic Brosamler formula revisited on some nonlinear Neumann boundary problems

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The principal aim is to study some kind of boundary value problems with nonlinear monotone condition

$$\left\{\begin{array}{rll} -\Delta u + \lambda u & = f & \text{in } \Omega \\ \langle \nabla u, \vec{\gamma} \rangle + \rho |u|^{\mathrm{m}-1} u & = \Phi & \text{on } \partial\Omega, \end{array}\right.$$

for $\lambda \geq 0,\ \rho > 0$ and $\mathrm{m} > 1$, where $\vec{\gamma}$ is an *oblique exterior vector* and $\partial\Omega$ consists only of regular points. Suitable approximations enable us to solve the problem by a *representation formulae* of the viscosity solution as a value function of a single Optimal Control problem controlled by a stochastic and reflecting dynamic system. Although other generalizations are possible, by simplicity we limit our contribution to the presence of nonlinear terms exclusively on the boundary of the domain.

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