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Min-max formulas for nonlocal elliptic operators and applications

A mapping F between spaces of real valued functions is said to have the Global Comparison Property (GCP) if $u \leq v$ everywhere with $u = v$ at some point x means that $F(u) \leq F(v)$ at this point x . A classical result of Courrège says that a continuous linear map from $C^2(\mathbb{R}^d)$ to $C^0(\mathbb{R}^d)$ has the GCP if and only if it is a sum of jump and drift-diffusion operators. In work with Russell Schwab, we characterize nonlinear maps having the GCP as those given by a min-max of linear operators having the GCP. This result provides representation formulas for the Dirichlet-to-Neumann map of nonlinear elliptic equations, and for the interface velocity for various free boundary problems, respective applications will be discussed along with a list of related open questions.