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“Harnack inequalities and exponential separation for linear parabolic equations”

ABSTRACT:

We consider the Dirichlet or oblique derivative problem for linear nonautonomous second order parabolic equations with bounded measurable coefficients on bounded Lipschitz domains. Using new Harnack-type inequalities, we show that each positive solution exponentially dominates any solution which changes sign for all times. As an application of this result we establish the existence of a universal gap between the first (principal) eigenvalue and the rest of the spectrum of a uniformly elliptic operator. We also prove uniqueness (up to constant multiples) of positive entire solutions (solutions defined for all $t \in \mathbb{R}$) of the equations in question. Finally, in the Dirichlet case we examine continuity and robustness properties of a principal Floquet bundle and the associated exponential separation under perturbations of the coefficients and the spatial domain. Our main results extend in a natural way standard results on principal eigenvalues and eigenfunctions of elliptic and time-periodic parabolic equations. This is joint work with Peter Polacik and Mikhail Safonov.