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Substochastic semigroups and positive perturbations of boundary conditions

We study well-posedness of linear evolution equations on L^1 of the form

$$u'(t) = Au(t), \quad \Psi_0 u(t) = \Psi u(t), \quad t > 0, \quad u(0) = f, \tag{1}$$

where Ψ_0, Ψ are positive unbounded linear operators and the linear operator A is such that equation (1) with $\Psi = 0$ generates a substochastic semigroup on L^1. We provide sufficient conditions for the operator A to be the generator of a positive semigroup as well as of a stochastic semigroup. This extends the approach of Greiner [1] by considering unbounded Ψ and positive semigroups. We also show how to obtain stationary solutions of (1). We illustrate our results with a two-phase age-size-dependent cell cycle model given by a piecewise deterministic Markov process.

This talk is based on a joint work with P. Gwiżdż [2, 3].

References

[1] Günther Greiner, *Perturbing the boundary conditions of a generator*, Houston J. Math. **13** (1987), no. 2, 213–229. MR 904952

[2] Piotr Gwiżdż and Marta Tyran-Kamińska, *Densities for piecewise deterministic Markov processes with boundary*, Preprint (2018).

[3] ———, *Positive semigroups and perturbations of boundary conditions*, Preprint (2018).