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Strongly continuous semigroups associated with evolutionary equations

Evolutionary equations, as they were introduced in [1], are abstract operator equations of the form

$$(\partial_t \mathcal{M} + \mathcal{A})u = f,$$

where ∂_t denotes the derivative with respect to time, \mathcal{M} is a bounded linear space-time operator and \mathcal{A} is an unbounded spatial operator. In contrast to classical evolution equations, evolutionary equations are formulated on the whole real line as time horizon and so, no explicit initial condition is needed to complete the equation.

Within the framework of evolutionary equations we provide a way to incorporate initial value problems or, more generally, problems with prescribed history. The given initial data/history will enter the equation as a distributional right hand side. The main problem is to determine those data, which allow for a continuous solution. We define a space of admissible histories which allows us to associate a strongly continuous semigroup with the given evolutionary problem. The presented results were obtained in [2].

References

- [1] R. Picard, *A structural observation for linear material laws in classical mathematical physics*, Math. Methods Appl. Sci. **32** (2009), no. 14, 1768–1803.
- [2] S. Trostorff, *Exponential stability and initial value problems for evolutionary equations*, Habilitation thesis, TU Dresden, 2018.