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Weak Markov Processes as Linear Systems

Rolf Gohm

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A noncommutative Fornasini-Marchesini system (a multi-variable version of a linear system) can be realized within a weak Markov process (a model for quantum evolution). For a discrete time parameter this is worked out systematically as a theory of representations of structure maps of a system by a weak process.

We introduce subprocesses and quotient processes which can be described naturally by a suitable category of weak processes. A corresponding notion of cascade for processes induces a represented cascade of systems. We study the control theoretic notion of observability which turns out to be particularly interesting in connection with a cascade structure.

As an application we gain new insights into stationary Markov chains where observability for the system is closely related to asymptotic completeness in the scattering theory of the chain. This motivates a general definition of asymptotic completeness in the category of weak processes.

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