

Cospan/Span(Graph): an algebra for open, reconfigurable automata networks

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Abstract

Span(Graph) was introduced by Katis, Sabadini and Walters as a categorical algebra of automata with interfaces, with main operation being communicating-parallel composition. Additional operations provide also a calculus of connectors or wires among components. A system so described has two aspects: an informal network geometry arising from the algebraic expression, and a space of states and transition given by its evaluation in Span(Graph). So, Span(Graph) yields purely compositional, hierarchical descriptions of networks with a fixed topology. The dual algebra Cospan(Graph) allows to describe also the sequential behaviour of systems. Both algebras, of spans and of cospans, are symmetrical monoidal categories with commutative separable algebra structures on the objects. Hence, the combined algebra CospanSpan(Graph) can be interpreted as a general algebra for reconfigurable/hierarchical networks, generalizing the usual Kleene's algebra for classical automata. We present some examples of systems described in this setting.