

# A Compositional Approach to the Stochastic Dynamics of Gene Networks

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We propose a compositional approach to the dynamics of gene regulatory networks based on the stochastic  $\pi$ -calculus, and develop a representation of gene network elements which can be used to build complex circuits in a transparent and efficient way. To demonstrate the power of the approach we apply it to several artificial networks, such as the repressilator and combinatorial gene circuits first studied in Combinatorial Synthesis of Genetic Networks [GEHL2002]. For two examples of the latter systems, we point out how the topology of the circuits and the interplay of the stochastic gate interactions influence the circuit behavior. Our approach may be useful for the testing of biological mechanisms proposed to explain the experimentally observed circuit dynamics.

Joint work with Ralf Blossey and Andrew Phillips.

## References

- [GEHL2002] Călin C. Guet, Michael B. Elowitz, Weihong Hsing, Stanislas Leibler. Combinatorial Synthesis of Genetic Networks. *Science*, Vol 296, Issue 5572, 1466-1470 , 24 May 2002