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## Boolean versus continuous dynamics on simple two-gene modules

We investigate the dynamical behavior of simple modules composed of two genes with two or three regulating connections. Continuous dynamics for mRNA and protein concentrations is compared to a Boolean model for gene activity. Using a generalized method, we study within a single framework different continuous models and different types of regulatory functions, and establish conditions under which the system can display stable oscillations. These conditions depend only on general features such as the ratio of the relevant time scales, the degree of cooperativity of the regulating interactions, and the logical structure of the interactions. Our results combine and generalize the findings of several disconnected previous studies.

### REFERENCES

- [1] Gross, Thilo and Feudel, Ulrike, *Generalized models as a universal approach to the analysis of nonlinear dynamical systems* Physical Review E **73** (1) (2006).
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