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Pulse-transmission Oscillators: Autonomous Boolean Models and the Yeast Cell Cycle[1] VOLKAN SEVIM, XINWEI GONG, JOSHUA SOCOLAR, Physics Dept, Duke University — Models of oscillatory gene expression typically involve a constitutively expressed or positively autoregulated gene which is repressed by a negative feedback loop. In Boolean representations of such systems, which include the repressilator and relaxation oscillators, dynamical stability stems from the impossibility of satisfying all of the Boolean rules at once. We consider a different class of networks, in which oscillations are due to the transmission of a pulse of gene activation around a ring. Using autonomous Boolean modeling methods, we show how the circulating pulse can be stabilized by decoration of the ring with certain feedback and feed-forward motifs. We then discuss the relation of these models to ODE models of transcriptional networks, emphasizing the role of explicit time delays. Finally, we show that a network recently proposed as a generator of cell cycle oscillations in yeast contains the motifs required to support stable transmission oscillations.

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