

Incoherent Feedforward Loop as a Clock Signal for Synchronizing Signals in Biological Systems

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Abstract

Asynchronous signals in synthetic gene networks can result in fault outputs and system failure. To address this challenge and meet the growing demands for user-defined control in biomedical applications, this research proposes a clock signal to integrate input signals and generate a synchronized output. The clock signal utilizes an incoherent type-1 feedforward loop (I1-FFL) network, which exhibits stable behavior and enhanced response speed, as shown through mathematical models and simulations. Our proposed biological clock serves as a promising solution for synchronizing asynchronous inputs in synthetic gene networks, enabling temporal control over gene expression dynamics, and providing a timing reference for multi-input systems in various applications.

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