Rigorously proven chaos in chemical kinetics

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Since the groundbreaking work of Lorenz in the 1960s about chaos within meteorological models, endeavors have been made to show chaos in chemical reactions. Despite the numerous experimental results showing signs of chaos in different real-world chemical reactions and numerical simulation of abstract systems, there has not been any conclusive evidence of their mathematical models, kinetic differential equations, displaying chaotic behavior.

In this work, we introduce several formal chemical reactions that can rigorously be proven to exhibit this kind of behavior. These reactions are derived by transforming chaotic equations into kinetic differential equations, which we next translate into the kinetic differential equations of formal chemical reactions. The results represent a novel approach to understanding chaotic behavior within the realm of chemical kinetics by solving an old open problem.