Dynamical Systems

Modeling Motion, Shaping Progress

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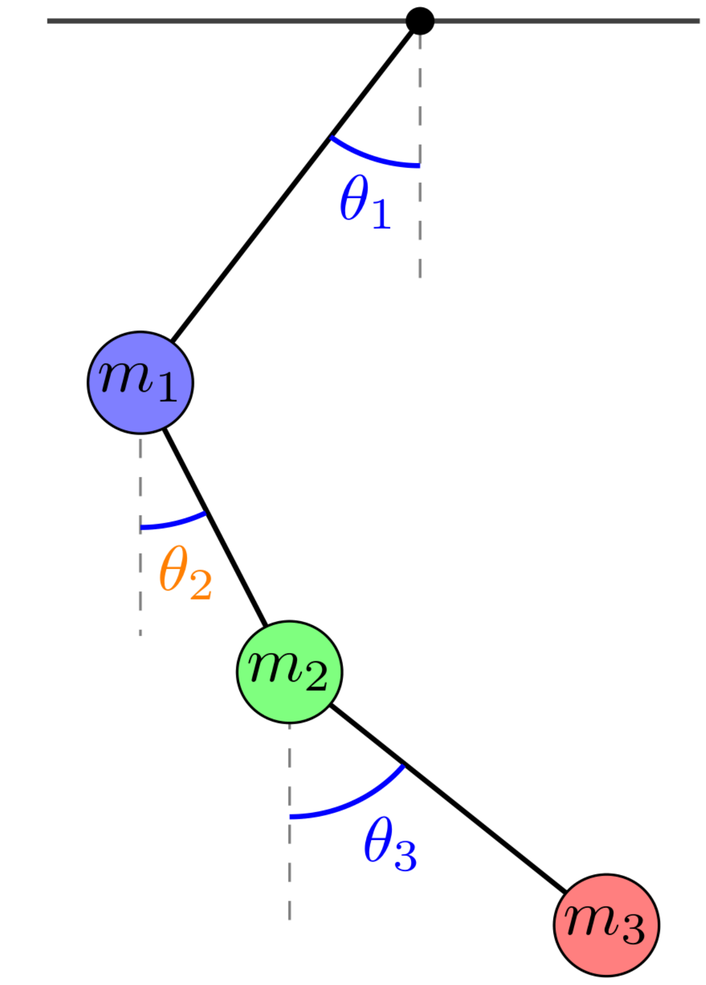
Abstract

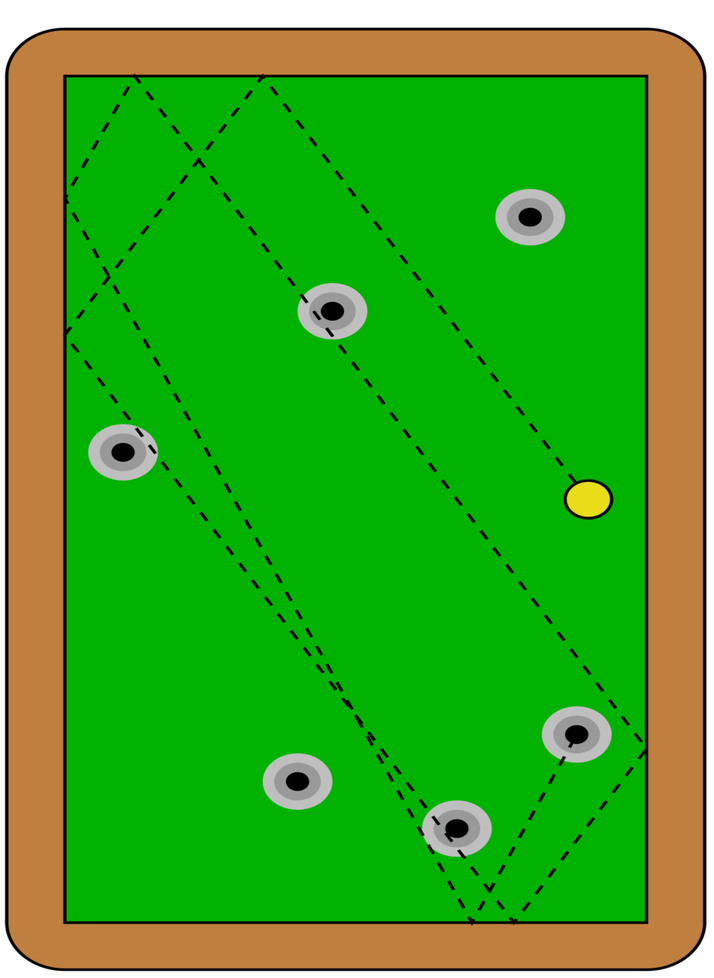
Our studies explore how trajectories behave in dynamical systems by applying topological, analytical and algebraic techniques. Through detailed analysis and a broad range of applications, our work aims to enhance our understanding of the mathematical models, providing new tools and insights for their study across various scientific domains. While our work explores potential applications, its primary goal is to advance fundamental mathematical knowledge, which has historically paved the way for a deeper understanding of reality and unforeseen applications. Our work can be summarized into three main studies:

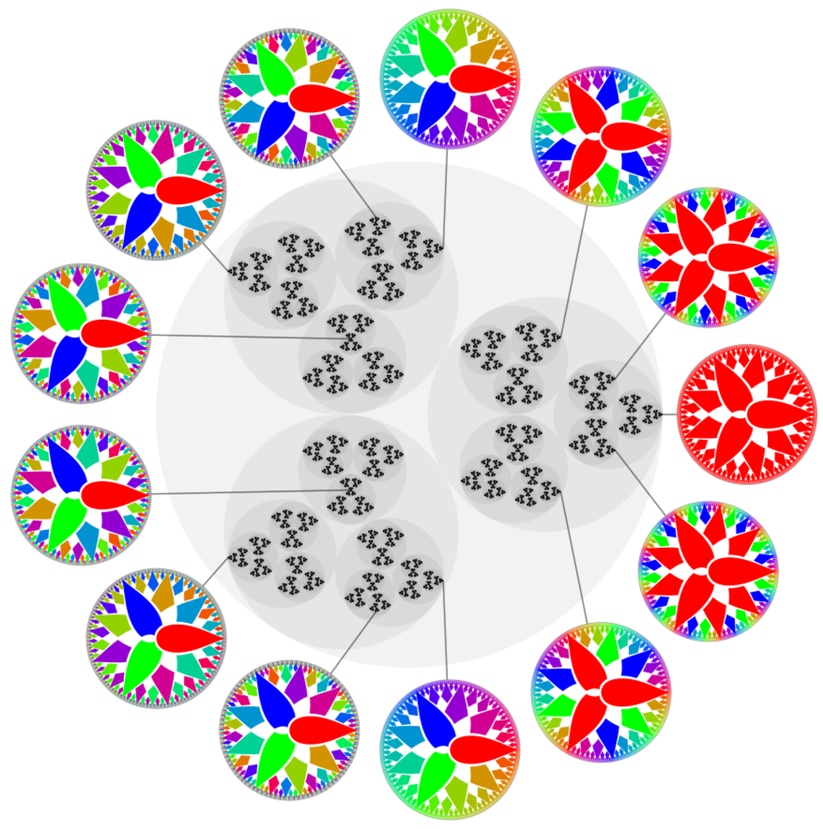
Pendulum-like periodic motions analysis in multi-dimensional systems provide valuable insights with practical applications in robotics, engineering, and biomechanics. This enhances both theoretical understanding and technological innovation.

Billiard dynamics with shrinking holes illustrate the interplay between motion and constraints. This approach offers insights into how trajectories adapt to narrowing opportunities, reflecting broader principles of predictability and randomness in dynamical systems.

p-Adic dynamical systems, with their hierarchical and fractal structure, offer promising applications in protein dynamics, quantum mechanics and computation. The latter can be approached through the study of the representations of the symmetry group of p-adic rotations. Inspired by the ultrametric structure of spin glasses, studied by Nobel G. Parisi, p-adic numbers model chaotic behavior and non equilibrium dynamics.







Research Impact

By developing new methodologies and analytical tools, this research supports advancements in key sectors like environmental management, engineering, and technology. The insights gained extend to global scientific efforts, influencing standards and practices in industrial and academic settings worldwide. The collaborative nature of this work fosters international cooperation, enriching the global scientific community and promoting innovation in dynamic systems analysis.

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