

Mathematical Models in Financial Technologies

Decentralized Finance, Smart Contracts, Blockchain-Based Financial Systems

The book explores the mathematical and computational techniques used in Decentralized Finance (DeFi) and Financial Technology (FinTech).

DeFi operates on smart contracts, which are self-executing programs that automate the necessary actions for conducting transactions on a blockchain.

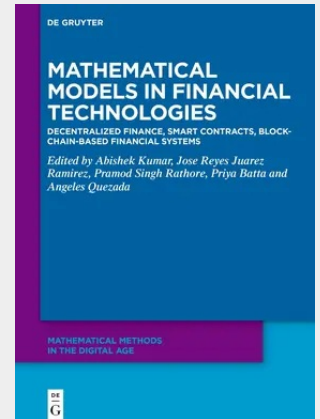
FinTech encompasses a broader range of services, including digital payments, mobile banking, and financial analytics, often powered by machine learning and data science. This book integrates mathematical concepts such as cryptographic algorithms, stochastic modeling, optimization, and game theory with computer science principles of Consensus mechanisms in cryptocurrency networks that include:

Proof-of-Work (PoW): Users solve complex computational puzzles to add new blocks to the blockchain.

Proof-of-Stake (PoS): Users validate transactions based on the number of coins they hold and are willing to 'stake' for network security.

The aim is to use such a combination to enhance the security, stability, and efficiency of automated systems for decentralized exchanges, lending protocols, and automated markets. Furthermore, advancements in computation—such as artificial intelligence, big data, and cloud computing—improve DeFi by enabling the prediction of asset movements, analyzing user behavior, and supporting scalable decentralized applications.

Despite rapid advancements, challenges remain, particularly in areas like smart contract vulnerabilities, market volatility, and regulatory compliance. Ongoing interdisciplinary research is focused on addressing these issues through improved composability and integration of mathematics with computation. These innovations promote global participation, transparency, and financial inclusion.



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