

Title : Frontiers in Generalized Recurrence Sequences: Identities, Powers, Periodicity, Block Structures, and Higher-Dimensional Extensions

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Abstract:

Recurrence sequences, originating from the classic Fibonacci sequence, play a foundational role across number theory, combinatorics, algebra, and modern cryptosystems. In recent years, structural, algebraic, and modular properties of generalized linear recurrence sequences have seen remarkable developments. This mini-symposium aims to bring together researchers working on linear and higher-order recurrence relations, their generalized variants, and their algebraic structures.

The session will focus on the theoretical and computational advancements in integer sequences including Fibonacci, Lucas, Pell, Jacobsthal, and right/left k -Fibonacci sequences, alongside their foundational identities and various properties. Attention will also be devoted to t -th powers of the terms of these generalized sequences, as well as their periodic behavior when reduced modulo 10^e ($e \geq 1$) or arbitrary prime and composite powers. Furthermore, the session will highlight structural pattern analysis, specifically the distribution and properties of blocks within the period of these modular sequences. Extending beyond standard sequence domains, the symposium may cover recent developments in higher-dimensional algebraic structures, such as the periodicity and arithmetic properties of Gaussian Fibonacci, Quaternion, and Octanion sequences modulo 10^e ($e \geq 1$). By bridging fundamental sequence theory with computational techniques and cryptographic applications, this mini-symposium seeks to explore novel theoretical frameworks and foster collaborative research in sequence theory.

Key Themes and Topics:

We invite contributions that address, but are not limited to, the following themes:

- **Generalized Recurrence Sequences:** Fibonacci, Lucas, Pell, Jacobsthal, and right/left k -Fibonacci sequences.
- **Power Sums & Identities:** Expressions for t -th powers ($t \geq 1$) of terms in generalized sequences.
- **Modular Arithmetic & Periodicity:** Pisano periods of recurrence sequences modulo 10^e ($e \geq 1$) and arbitrary power moduli.
- **Block Structures & Pattern Analysis:** Internal block distributions, symmetry, and repeat patterns within sequence periods.
- **Complex & Higher-Dimensional Extensions:** Gaussian Fibonacci, Quaternion, and Octanacci sequences and their periodicity modulo 10^e ($e \geq 1$).
- **Combinatorial & Matrix Methods:** Matrix representation methods, generating functions, and linear algebra applications in sequence evaluation.
- **Cryptographic & Algorithmic Applications:** Applications of periodic sequences, modular patterns, and pseudorandom sequence generation in modern cryptography and information security.

Keywords: Generalized Fibonacci sequences; Lucas and Pell sequences; k -Fibonacci sequences; Modulo 10^e periodicity; t -th power identities; Block patterns; Gaussian Fibonacci; Quaternion, and Octanion sequences.

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