

**DISIT**

DIPARTIMENTO DI SCIENZE E INNOVAZIONE TECNOLOGICA

SEMINARI RICERCA E FORMAZIONE

Mercoledì 26 Novembre 2025**ore 15:00-16:30****Aula 203**SEMINARIO/CORSO APERTO A:
Docenti, Assegnisti, Dottorandi,
Borsisti, StudentiSEMINARIO/CORSO IN LINGUA:
Inglese

On the curious life of Tartaglia's triangle in higher dimensions and some applications in Combinatorics and Clifford Analysis

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Let i and j be two of the three imaginary and non-commutative units of Hamilton's quaternion $q = x_0 + x_1i + x_2j + x_3k$. Starting with the search for a simple formula of the expansion of $(i + j)^n$, we show how the introduction of an n -fold product leads us to Tartaglia's triangle. As a consequence and generalization, interesting combinatorial identities follow, leading directly to a class of polynomials (generalized *Appell polynomials*) that play a fundamental role in *Clifford Analysis* (generalized *Complex Analysis* based on the use of a Clifford Algebra). The consistent use of multiple hypercomplex variables, which are in a sense dual to multiple complex variables, laid the foundation for these discoveries, which have only been made in less than two decades.

- [1] L. Aceto, H. R. Malonek, G. Tomaz, *Matrix approach to hypercomplex Appell polynomials*. Applied Numerical Mathematics 116, (2017), 2-9
- [2] H. R. Malonek, I. Cacao, M. I. Falcão, G. Tomaz, *Harmonic Analysis and Hypercomplex Function Theory in Co-dimension One*. In: A. Karapetyants, V. Kravchenko, E. Liffyand (eds) Modern Methods in Operator Theory and Harmonic Analysis. OTHA 2018. Springer Proceedings in Mathematics & Statistics, vol 291. Springer, Cham. (2019)
- [3] D. Alpay, I. L. Paiva, D. Struppa, *A general setting for functions of Fueter variables: differentiability, rational functions, Fock module and related topics*. Israel Journal of Mathematics, 236, (2020), 207-246

