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A Mathematical Framework for Two-Dimensional Diffraction Phenomena Based on Biquaternions

This talk presents a mathematical framework for describing two-dimensional diffraction phenomena using biquaternions. In particular, biquaternionic counterparts of the two-dimensional Helmholtz–Kirchhoff integral theorem, the Fresnel–Kirchhoff diffraction formula, and the Rayleigh–Sommerfeld diffraction formula are derived. These results provide the foundation for a biquaternionic formulation of two-dimensional diffraction phenomena capable of treating scalar and vector fields within a unified framework. This approach offers an attractive alternative to traditional methods, particularly in settings where simultaneous analysis of scalar and vector components is required. As a special case, the classical one-dimensional Fresnel–Kirchhoff diffraction formula is recovered. This result serves as a consistency check and confirms the mathematical validity of the proposed framework. This is a joint work with Wanderson Maia Pimenta.