Construction of polynomial minimal surfaces with Pythagorean normals

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A novel approach to the construction of polynomial minimal surfaces (surfaces of zero mean curvature) with isothermal parameterizations from Pythagorean triples of complex polynomials will be presented. The resulting surfaces turn out to be Pythagorean normal (PN), i.e., their unit normal vectors have a rational dependence on the surface parameters. This construction generalizes a prior approach based on Pythagorean triples of real polynomials, and yields more shape parameters for surfaces of a specified degree. Moreover, when one of the complex polynomials is just a constant, the minimal surfaces have the Pythagorean–hodograph (PH) preserving property (a planar PH curve in the parameter domain is mapped to a spatial PH curve on the surface). Cubic and quintic examples of these minimal PN surfaces will be presented, including examples of solutions to the Plateau problem, with boundaries generated by planar PH curve segments in the parameter domain. Finally, an application to the problem of interpolating three given points in the space as the corners of a triangular cubic minimal surface patch, such that the three patch sides have prescribed lengths, will be addressed.

Joint work with: Rida T. Farouki, Marjeta Knez and Vito Vitrih.