

(2+1) Regge Calculus: Discrete Curvatures, Bianchi Identity, and Gauss-Codazzi Equation

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Our first results are the clear definitions of both intrinsic and extrinsic discrete curvatures in terms of holonomy and plane-angle representation, a clear relation with their deficit angles, and their clear geometrical interpretations in the first order discrete geometry. The second results are the discrete version of Bianchi identity and Gauss-Codazzi equation, together with their geometrical interpretations. It turns out that the discrete Bianchi identity and Gauss-Codazzi equation, at least in 3-dimension, could be derived from the dihedral angle formula of a tetrahedron, while the dihedral angle relation itself is the spherical law of cosine in disguise. Furthermore, the continuous infinitesimal curvature 2-form, the standard Bianchi identity, and Gauss-Codazzi equation could be recovered in the continuum limit.