

The edge of torn elastic sheets and growing leaves often form a hierarchical fractal like buckling pattern. These complex morphologies can be understood as low elastic energy isometric immersions of hyperbolic geometries. In this talk we show that for a large class of growth profiles there exist periodic and self-similar deformations of the sheet with which exactly match the imposed geometry. The construction of these surfaces consists of gluing together local solutions of an isometric immersion problem along lines of inflection joined together at branch points in such a manner that the resulting surface has finite bending content. For hyperbolic geometries, complex wrinkling patterns are thus possible and our results identify the key role the regularity of the isometric immersion plays in determining the global fractal like patterns that are observed in practice.