What Properties Define the Eulerian Sequence? A Computer-Inspired Analysis

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The concept of the Euler Line was first published by the Swiss mathematician Leonhard Euler in his dissertation “Variae Demonstrationes Geometriae.” Through inductive reasoning, we discovered which polygons contain the Euler Line and hence denoted this subset of polygons as “The Eulerian Sequence.” We then asked the following question: What properties define the Eulerian Sequence? We integrate various computer simulations in order to collect observations and utilize Java Topology Suite and JavaFX to compute the exact locations of the special points. These libraries allow us to gather geometric observations to eventually prove properties of the sequence. Through various analytical techniques, we validated our conjectures of the Eulerian Sequence. Using topological techniques, we also establish the relevance of the sub-polygon created by the special points. In addition to establishing the conditions for an Eulerian Polygon, we ultimately proved several algebraic and geometric properties of the Eulerian Sequence. Our computer simulations reveal remarkable applications of the Eulerian Sequence. For instance, our method of computing special points within an Eulerian Polygon, which we denote as Eulerian Decomposition, displays a similarity to folding and Origami problems that are relevant to various optimization and packing problems. Our work can also be useful in finding optimal locations of resource allocation on an n-boundary map. Above all, our utilization of computer simulations remains a critical inspiration to our analyses and applications.

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