

Acute angle: An angle whose measure is less than 90 degrees.

Angle: A pair of Zome System struts that share the same Zome System node but do not lie on the same line.

Archimedes: Greek philosopher and mathematician (287 BC-212 BC). He was the first person to describe the semi-regular solids.

Archimedean solid: Also known as **semi-regular solids**. A group of 13 polyhedra defined by the Greek philosopher Archimedes. Archimedean solids have regular polygon faces of two or more kinds and all alike vertices.

Area: A measure, in square units, of how much 2-dimensional space is occupied by a given 2-dimensional figure.

Axis: The line formed by any Zome System strut and the strut on the exact opposite side of the node.

Bilateral symmetry: The repetition of parts by a mirror reflection across the center line of given object.

Blue struts: Fit into the rectangular holes in the node. The blue struts are the “unity struts” which are used to build all regular polygons and polyhedra.

Blue line: Line created by blue struts. Structures built on planes perpendicular to a blue line will frequently display 2-fold and 4-fold symmetries.

Buckyball: Popular name for the Carbon 60 (C^{60}) molecule. The buckyball was discovered in the late 1980s and is the first new form of carbon to be created beyond the naturally occurring forms graphite and diamond. A Zome System model of a Buckyball is made by building a sphere consisting of 12 regular pentagons and 20 regular hexagons. The geometric name for this shape is truncated icosahedron.

Buttress: A structure projecting from a large expanse of wall. The buttress supports the wall from the outside. Gothic cathedrals used buttresses to strengthen walls weakened by huge stained glass windows.

Color coding: In addition to being coded according to shape the Zome System struts are also coded according to color. Rectangular struts are blue. Triangular struts are yellow. Pentagonal struts are red. Nodes are a neutral white.

Concave polygon: A polygon that has some interior vertex angles which are 180 degrees or more; i.e. one of the vertices “points in”.

Concave polyhedron: A polyhedron that has some dihedral angles which are 180 degrees or more.

Congruent, congruency: Two or more geometric figures are congruent if all their angles and edges and faces are exactly the same.

Convex polygon: A polygon that has all interior vertex angles less than 180 degrees.

Convex polyhedron: A polyhedron that has all dihedral angles less than 180 degrees.

Cross-section: Any slice, real or imaginary, through any object to see inside it.

Crystal: A solid state of matter where the atoms are in a periodic or a quasi-periodic arrangement. It is possible to build a wide range of crystal forms with Zome System. Examples of crystals include sodium chloride (table salt), quartz (silica), graphite (a form of carbon).

Crystalline lattice: The actual arrangement of atoms in a given crystal. If the structure is periodic there are 230 possible arrangements.

Cube: Polyhedron shape consisting of six square faces. The regular cube can be built in Zome System using blue struts. The cube, which is also known as a “hexahedron”, is one of the five Platonic solids.

Cuboctahedron: One of the 13 Archimedean (semi-regular) solids. It has 6 square faces and 8 triangle faces. Each vertex has 2 squares and 2 triangles. Requires the supplementary green struts to build.

Deca: A Greek prefix meaning 10.

Decagon: Ten-sided polygon. The equilateral decagon is built with blue struts.

Dodeca: A Greek prefix meaning 12.

Dodecagon: A polygon having 12 sides.

Dodecahedron: One of the 5 Platonic (regular) solids. It has 12 pentagon faces. Each vertex has 3 pentagons. A polyhedron with twelve faces. The regular dodecahedron has pentagonal faces, and is one of Plato’s solids

Dihedral angle: The inside angle between 2 adjacent (sharing an edge) polygon faces of a polyhedron.

Divine proportion: A different name for the “Golden Section”.

DNA strand: A piece of a spiral DNA molecule. DNA carries all the genetic information of every living thing on earth.

Edge: Lines (struts) which form the boundary of a polygon, polyhedron or a polytope.

Enneacontahedron: A polyhedron consisting of 90 rhombic faces of 2 different kinds. Sixty fat rhombi and 30 skinny rhombi, 90 faces in total. The enneacontahedron can be built in Zome System using one length of yellow strut.

Equilateral: Having lines (struts) of all the same length.

Euler, Leonhard: Swiss mathematician (1707-1783)

Euler’s formula: General formula that applies to all convex polyhedra: $F+V-E=2$, or $F+V=E+2$. Where F =number of faces, V =number of vertices, and E =number of edges. This relationship was first documented by the Leonhard Euler in 1752. Students can show that the formula always holds up by experimenting with Zome System.

Face: A polygon piece of a polyhedron.

Fibonacci sequence: A series of numbers where each number is the sum of the two numbers before it in the sequence. The entire sequence is 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144... ($0+1=1$, $1+1=2$, $2+1=3$, $3+2=5$, $5+3=8$, $8+5=13$...). Zome System struts also work in this sequence; short strut + medium strut = long strut, medium strut + long strut = next length strut...). Fibonacci numbers can be found in virtually all plants with spiraling patterns. For example, a pine cone has 8 spirals going in one direction, and 13 going in the other. The seeds of a strawberry also grow in spirals, 13 in one direction, and 21 in the other. Cauliflower florets combine in spirals of 5 and 8, and sunflowers have 34 and 55 spirals of seeds.

The Fibonacci sequence was first documented in the 13th century by the Italian mathematician Leonardo of Pisa, who was also known as Fibonacci (son of Bonacci).

5-Fold symmetry: Repeating a motif by 5 reflections or 5 rotations around a central point. Five-fold symmetries and clusters of five are very common in nature. Apples have a five-point star in the middle, starfish are five-point stars, lots of flowers and leaves have clusters of five petals or points. Most mammals have 5 fingers and toes. An acorn squash and a pumpkin has 10 sections (5×2).

Fractal progression: A pattern which repeats itself at different levels of size. For example, a cauliflower head displays fractal geometries in its spirals. The spirals are made of smaller spirals which in turn are made of even smaller spirals and so on. The famous Mandelbrot set is another example of a fractal progression. Zome System can build fractal star progressions in Golden sections.

Fuller, R. Buckminster: Famous 20th century American architect and inventor of the Geodesic dome. Fuller also designed many space frames (triangulated structures).

Fullerene: A family of laboratory-created molecules that includes C^{60} (Buckyball), and C^{240} . The name Fullerene was given because the structures of these molecules reminded researcher of the geodesic domes created by R. Buckminster Fuller. Zome System can be used to model a wide range of Fullerenes.

Geodesic dome: A symmetrical tiling of triangles covering a sphere. These structures are extremely strong and light, giving the maximum strength for the minimum amount of building material.

Geometric progression: A number sequence in which each successive term may be found by multiplying by the same number each time.

Golden rectangle: Rectangle built with short and medium, or medium and long blue struts. The sides of this rectangle are in the famous Golden section.

Golden rectangle grid: This structure shows the infinite spiral of squares contained in the Golden rectangle.

Golden section: Also known as the Divine Proportion, and as the Golden Mean. Irrational number noted with the Greek letter τ (tau) = 1.61802... The exact value can be calculated to any desired accuracy from the formula $\tau = \text{square root } 5 + 1/2$. Golden section proportions are very important in classical art and architecture. All Zome System struts are in golden sections of each other.

Great rhombicuboctahedron: One of the 13 Archimedean (semi-regular) solids. It has 6 octagon faces, 8 hexagon faces and 12 square faces. Each vertex has 1 octagon, 1 hexagon and 1 square. Requires blue and green struts to build in Zome System.

Great rhombicosadodecahedron: One of the 13 Archimedean (semi-regular) solids. It has 12 decagon faces, 20 hexagonal faces and 30 square faces. Each vertex has 1 decagon, 1 hexagon and 1 square. Can be built with blue struts.

Great stellated dodecahedron: A star polyhedron produced by placing 20 triangular pyramids on the 20 triangular faces of the regular icosahedron.

Green struts: These supplementary Zome System struts add 30 buildable angles while being fully compatible with all current components. Now available! For more information go to www.zomesystem.com.

Heptagon: A polygon having 7 sides.

Hexa: A Greek prefix meaning 6.

Hexagon: A polygon having 6 sides.

Hexahedron: Correct name for the cube, a polyhedron with six square faces.

Isosceles triangle: A triangle with 2 equal sides and 2 equal angles.

Icosa: A Greek prefix meaning 20.

Icosadodecahedron: One of the 13 Archimedean (semi-regular) solids. It has 12 pentagon faces and 20 triangle faces. Each vertex has 2 pentagons and 2 triangles. Can be built with blue struts.

Icosahedron: Polyhedron with 20 faces. The regular icosahedron has 20 equilateral triangles as faces. This shape is one of Plato's five solids. Can be built with blue struts.

Irrational: Any number with an infinite number of decimal places but no repeating pattern.

Kepler, Johannes: (1571-1630) German mathematician and astronomer. Discovered both stellations of the regular dodecahedron, the rhombic triacontahedron, the rhombic dodecahedron and non-periodic tilings. Kepler also devised a model of the solar system based on the relationship between the 5 regular solids to explain the relative distances of the planets from the Sun.

Kepler tilings: Periodic and non-periodic tilings of pentagrams, pentagons and decagons.

Keplerian solids: The edge stellated icosahedron and the edge stellated dodecahedron. These are starry pointed shapes created if we extend the edges of an icosahedron or a dodecahedron.

Kite: A quadrilateral that has 2 pairs of edge lengths. The opposite edges are not equal length.

Length: A measure, in line segment units of how much 1 dimensional space is occupied by a given one dimensional object.

Line: A continuous set of points which is straight and extends without end in both directions.

Modularity: Having a small number of types of component parts which can be combined in many configurations.

Node: A Zome System connector ball. In the original Zome System kits the nodes are white. Zome System also manufactures colored nodes that are primarily used by various researchers working in chemistry and materials science.

Nomenclature: A standardized system of naming objects or processes.

Non-periodic: Having a motif which does not repeat by translations.

Obtuse angle: An angle of 180 degrees or more.

Octa: A Greek prefix meaning 8.

Octagon: A polygon having 8 sides.

Octahedron: A polyhedron with 8 faces. The regular octahedron, which consists of 8 equilateral triangles, is one of Plato's solids. Although it is possible to build a large number of octahedra with the regular Zome System struts, the regular octahedron requires the supplementary green struts.

Oct-tet truss: An infinite periodic network of regular octahedra and regular tetrahedra. When built as a structure of metal bars an extremely strong structure results. The first person to use this type structure was Alexander Graham Bell. Bell built kites with oct-tet trusses, including one large enough to carry a man aloft (well before the Wright brothers first flight!).

Parallel Lines: 2 lines are said to be parallel if they lie in the same plane and do not intersect.

Parallel Projection: To cast a shadow with a light source that is infinitely far away from the object.

Parallelogram: A quadrilateral in which opposite sides have equal lengths and are parallel.

Penta: A Greek prefix meaning 5.

Pentagon: A polygon having 5 sides.

Pentagram: A star shape created by extending (stellating) the edges of a pentagon.

Periodic: Having infinite repetition of the same motif in one continuous straight line direction.

Perpendicular line: A line at 90 degrees to another line.

Perspective projection: To cast a shadow with a light close to the object.

Phi, ϕ : One of two Greek symbols for the Golden section (Divine proportion). This one is used more by artists and people interested in the more esoteric aspects of the Golden section.

Plane: An infinite flat surface that has no boundaries.

Platonic solid: The Platonic (regular) solids are convex polyhedra with all faces are one kind of regular polygon and all vertices are identical. They are named after the Greek philosopher and mathematician Plato, who lived around 500 BC. Plato proved that there only exists 5 such shapes; the Tetrahedron, Hexahedron, Octahedron, Dodecahedron, and Icosahedron.

Polygon: A closed chain of line segments. The lines intersect only at their endpoints and no two line segments lie along the same line .

Polyhedron: Three-dimensional geometric shape where each face is a polygon. The plural form is polyhedra. Another name for polyhedron is solid.

Polytope: A geometric figure of any dimension higher than 3.

Prime factor: Any number which is only dividable by itself and by 1.

Prism: A polyhedron whose top and bottom faces are identical and parallel and whose side faces are all parallelograms.

Projection: To cast a shadow so that every point in a given shape has a corresponding point in the shadow.

Proportion: An equality between two ratios (for example: $2/3 = 4/6$)

Pyramid: A polyhedron formed by joining the endpoints of a polygon to a point not in the same plane. The remaining faces formed are all triangles.

Quadrilateral: Any polygon with four sides. All kites, parallelograms, rectangles, rhombuses, squares, trapezoids are quadrilaterals, as are any other convex or non-convex polygon with 4 sides.

Quasicrystal: A type of crystal having a 3-dimensional non-periodic structure.

Ratio: A number obtained by dividing one number into another. This relation is called the ratio between those two numbers (for example: the ratio between 2 and 3 is $2/3 = .666666\dots$)

Rectangle: A quadrilateral whose opposite sides are equal length and whose vertex angles are all 90 degrees.

Red struts: Fit into the pentagonal holes in the node. Structures built in the plane perpendicular to this strut will have 5-fold symmetries.

Regular polygon: A polygon whose edge lengths and vertex angles are all equal.

Regular polyhedron: A polyhedron whose faces are all one kind of regular polygon and all the vertices are identical

Richert / Penrose tilings: Tilings consisting of 2 types of tile, a 72 degree rhombus and a 36 degree rhombus. These tilings can be non-periodic. These tilings were independently discovered by the structural artist Clark Richert in 1971 and by the famous mathematical physicist Roger Penrose in 1975.

Right angle: An angle of 90 degrees.

Rhombi: The plural of rhombus

Rhombus: A quadrilateral whose sides are all equal in length. While diamond shapes are most commonly referred to as being rhombi, the definition also includes squares.

Rotational symmetry: A repetition of a pattern by rotating it around a fixed point by any whole number division of 360 degrees.

Scale: Relative size

Semi-regular solid: See Archimedian solid.

Shadow: Image on a surface created by holding an object between that surface and a light source.

Similar: Having the same shape (same angles etc.) but a different size.

Small rhombicosadodecahedron: One of the 13 Archimedian (semi-regular) solids. It has 12 pentagon faces, 20 triangular faces and 30 square faces. Each vertex has 1 pentagon, 1 triangle and 2 squares. Can be built with blue struts.

Small rhombicuboctahedron: One of the 13 Archimedean (semi-regular) solids. It has 6 square faces, 8 triangular faces and 12 more square faces. Each vertex has 3 squares and 1 triangle. Requires the supplementary green Zome System struts.

Small stellated dodecahedron: A star polyhedron produced by placing 12 pentagonal pyramids on the 12 pentagonal faces of the regular dodecahedron.

Snub cube: One of the 13 Archimedean (semi-regular) solids. It has 12 pentagon faces and 80 triangle faces. Each vertex has 1 pentagon and 4 triangles. Can not be built with Zome System.

Snub dodecahedron: One of the 13 Archimedean (semi-regular) solids. It has 12 pentagon faces and 80 triangle faces. Each vertex has 1 pentagon and 4 triangles. This polyhedron cannot be built using Zome System.

Solid: Alternative name for a polyhedron. Certain families of solids are named for the mathematician or philosopher who is best known for documenting them, such as Platonic solids and Archimedean Solids.

Space frame: In general, a space frame is a triangulated framework made from struts in rigid materials such as steel or wood. Because of the triangulation such structures are extremely strong and light.

Square: A quadrilateral whose edges are equal and whose vertex angles are all 90 degrees. The correct name for the square following geometry naming convention is “regular tetragon”.

Star polyhedron: A non convex polyhedron produced by erecting pyramids on all the faces of a convex polyhedron.

Stellation, Stellated: A process of extending the plane faces and/or line edges of a polygon or a polyhedron until they meet to produce a starry shape.

Surface area: Total area of all the polygon faces of the polyhedron.

Symmetry, Symmetrical: Repetition of a motif by a rotation around a fixed point, a reflection across a line or plane, or by a translation along fixed distances.

Tau, τ : One of two Greek symbols for the Golden section (Divine proportion). This one is used mostly by mathematicians. The exact definition of τ is:

$$\tau = \frac{1 \pm \sqrt{5}}{2} = 1.6180339\dots$$

Tessellation: Comes from the Latin word `tessera` which means tile. A tessellation is simply a tiling of polygons.

Tetra: A Greek prefix meaning 4.

Tetrahedron: A polyhedron with four triangular faces. A total of 64 different tetrahedra can be built with Zome System. The regular tetrahedron, where all faces are equilateral triangles, can only be built with the supplementary green Zome System struts.

3-Dimensional: Any object having length, width and depth.

3-fold symmetry: Repetition of a motif by a rotation of $1/3$ of 360 degrees (120 degrees) about a fixed center point. Examples include: honeycomb, snow flake, clover, the cross section of a green pepper, cucumber, banana, etc.

Translational symmetry: Repetition of a motif by moving it a fixed distance in a fixed direction, infinitely many times if one wishes.

Trapezoid: A quadrilateral that has one pair of opposite sides parallel and the other pair are not parallel.

Tria: A Greek prefix meaning 3.

Triaconta: A Greek prefix meaning 30.

Triacontahedron: A polyhedra shape consisting of 30 rhombic faces. The triacontahedron can be built in Zome System using the red struts.

Triangle: Polygon with three sides and three angles.

Triangular reinforcement: See "triangulation"

Triangulation: Process of making a structure stronger by adding braces that form triangles.

Truncate: To cut off the vertices of a polyhedron.

Truncated cube: One of the 13 Archimedean (semi-regular) solids. It has 6 octagon faces and 8 triangle faces. Each vertex has 2 octagons and 1 triangle. Requires the supplementary green Zome System struts.

Truncated dodecahedron: One of the 13 Archimedean (semi-regular) solids. It has 12 decagon faces and 20 triangle faces. It has 12 decagon faces and 20 triangle faces. Each vertex has 2 decagons and 1 triangle.

Truncated icosahedron: One of the 13 Archimedean solids. It has 12 pentagon faces and 20 hexagon faces. Each vertex has 1 pentagon and 2 hexagons. This is the shape of the Carbon 60 Buckyball molecule.

Truncated octahedron: One of the 13 Archimedean solids. It has 6 square faces and 8 hexagon faces. Each vertex has 1 square and 2 hexagons. This shape can pack with copies of itself to fill 3-Dimensional space without gaps. Requires the supplementary green Zome System struts.

Truncated tetrahedron: One of the 13 Archimedean (semi-regular) solids. It has 4 hexagon faces and 4 triangular faces. Each vertex has 2 hexagons and 1 triangle. Requires the supplementary green Zome System struts.

Truss: A special case of a space frame.

2-Dimensional: Any figure having width and depth but no height.

Vertex: The “point” or “corner” of any polygon or polyhedra. In the Zome System system the vertices are represented by the white nodes.

Volume: A measure, in cubical units of how much 3 dimensional space is occupied by a given 3 dimensional object.

Yellow struts: Fit into the triangular holes in the node. Structures built in the plane perpendicular to the yellow struts have 3-fold symmetries.

Zonogon: A special type of polygon having even number of sides. The opposite sides are parallel and equal in length. An example of a zonogon is a parallelogram.

Zonohedron: A special type of polyhedron having all zonogon faces. The opposite faces are all parallel planes. An example of a zonohedron is a rhombic triacontahedron which has 30 rhombic faces. This shape can be built with Zome System red struts.