420.00   Isotropic Vector Matrix
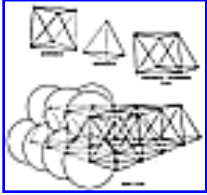
420.01   When the centers of equiradius spheres in closest packing are joined by most economical lines, i.e., by geodesic vectorial lines, an isotropic vector matrix is disclosed— "isotropic" meaning "everywhere the same," "isotropic vector" meaning "everywhere the same energy conditions." This matrix constitutes an array of equilateral triangles that corresponds with the comprehensive coordination of nature's most economical, most comfortable, structural interrelationships employing 60-degree association and disassociation. Remove the spheres and leave the vectors, and you have the octahedron- tetrahedron complex, the octet truss, the isotropic vector matrix. (See Secs. 650 and 825.28.)
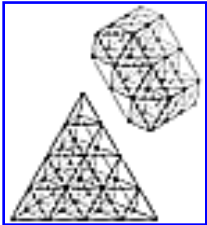
420.02   The isotropic vector matrix is four-dimensional and 60-degree coordinated. It provides an omnirational accounting system that, if arbitrarily accounted on a three- dimensional, 90-degree basis, becomes inherently irrational. The isotropic vector matrix demonstrates the ability of the symmetrically and asymmetrically terminaled, high- frequency energy vectors to accommodate the structuring of any shape. (See Sec. 923.)

420.03   Our extension of the Avogadro hypothesis (Sec. 410) generalizes that all energy conditions are the same. Inasmuch as vectors describe energy conditions, this would mean a volumetric aggregation of vectors in a structural complex in which all of the interacting vectors would have to be of the same length and all of their intersecting angles would have to be the same. This state of omnisameness of vectors stipulates the "isotropic," meaning everywhere the same. This prescribes an everywhere state of equilibrium.
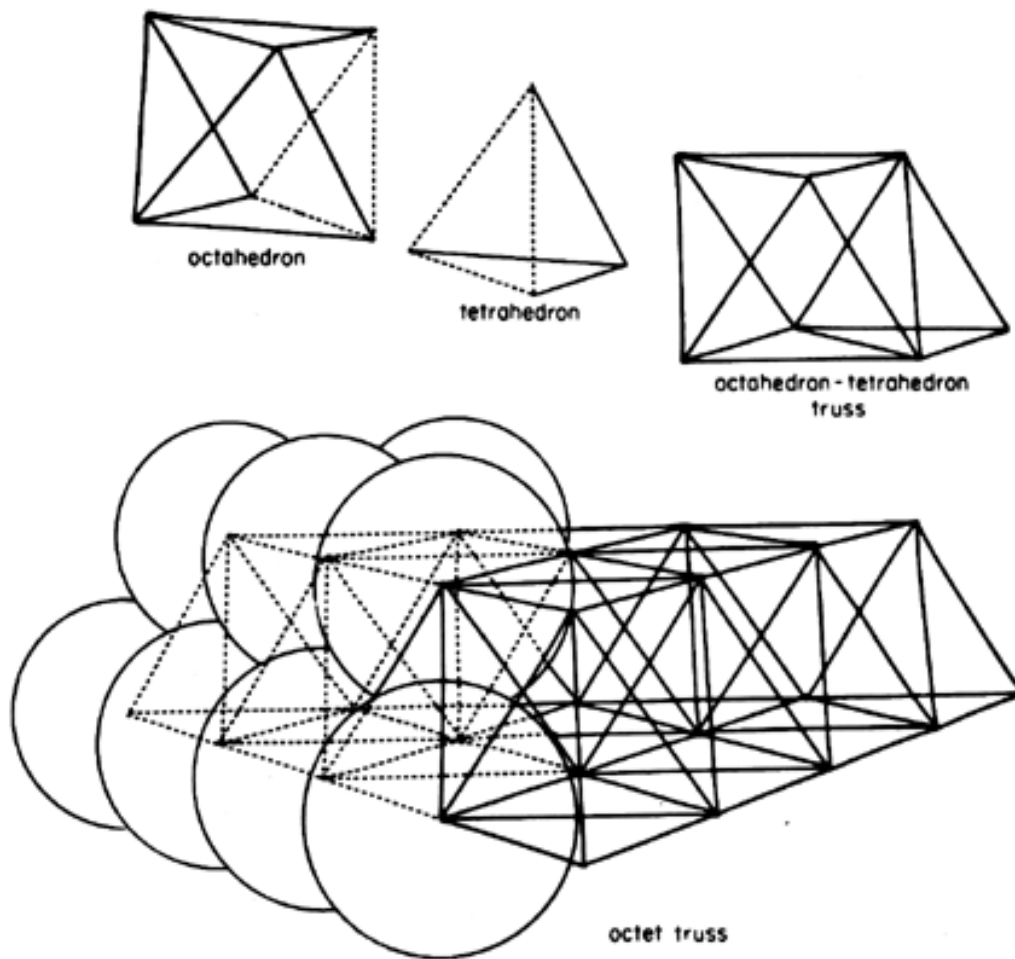
420.04   **Equilibrium**

octahedron

tetrahedron

octahedron - tetrahedron
truss

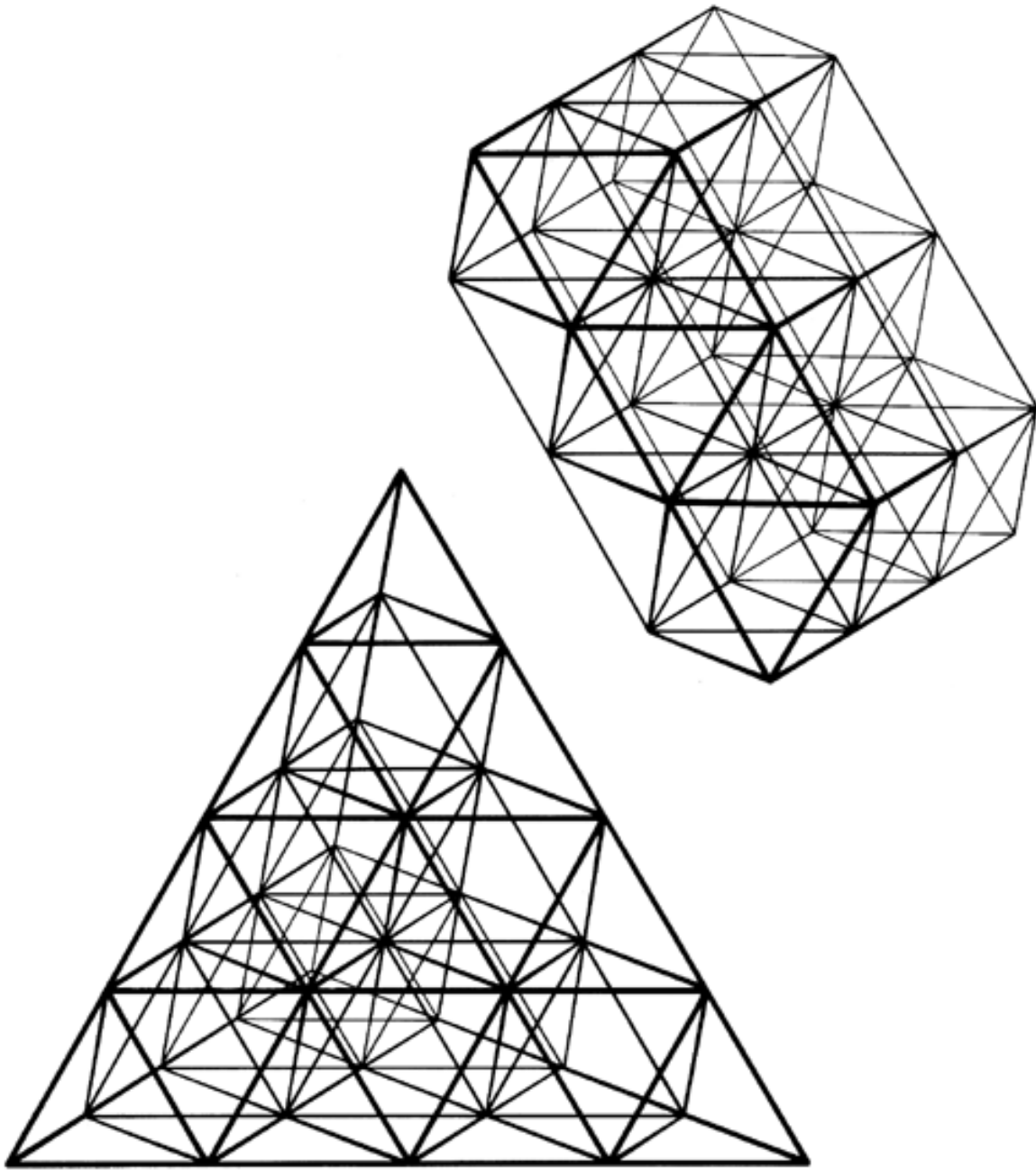octet truss

Fig. 420.01 Octet Truss.

Fig. 420.02 When the centers of equiradius spheres in closest packing are joined with lines, an isotropic vector matrix is formed. This constitutes an array of equilateral triangles which is seen as the comprehensive coordination frame of reference of nature's most economical, most comfortable structural interrelationships employing 60-degree association and disassociation. This provides an omnirational accounting system which, if arbitrarily accounted on a 90-degree basis, becomes inherently irrational. The isotropic vector matrix demonstrates the capability of accommodating all symmetrically and asymmetrically terminaled, high-frequency energy vectors of any structural shaping.

420.041   Nature is said to abhor an equilibrium as much as she abhors a perfect vacuum or a perfect anything. Heisenberg's indeterminism and quasiprecision mechanics' recognition of inherent inaccuracy of observation or articulation seems to suggest that the asymmetric deviations and aberrations relative to equilibrium are inherent in the imperfection of a *limited* life of humans with a tightly limited range of perceptible differentiation of details of its experience. Nature demonstrates her abhorrence of equilibrium when an airplane in flight slows to a speed that reduces the airfoil "lift" and brings the airplane's horizontal flight forces into equilibrium with Earth gravity's vertically Earthward pull. The plane is said then to stall, at which moment the plane's indeterminate direction makes it unmanageable because the rudder and elevator surfaces lack enough passing air to provide steerability, and the plane goes swiftly through equilibrium and into an Earthward-spinning plunge. Despite the untenability of equilibrium, it seemed to me that we could approach or employ it referentially as we employed a crooked line—the deliberately nonstraight (see Sec. 522) line that approaches but never reaches the perfect or exact. A comprehensive energy system could employ the positive and negative pulsations and intertransformative tendencies of equilibrium. The vector equilibrium became the logical model of such omnidimensional, omniexperience-accommodation studies. Because we have learned that scientists have experimental evidence only of waves and wavilinearity and no evidence of straight lines, it became evident that the radial and circumferential vectors of the vector equilibrium must be wavilinear, which meant that as coil springs when compressioned will lessen in length and when tensed will be increased in length—ergo, the explosive disintegrative radial forces of Universe would compress and lessen in outward disintegrative length and would be well inside the closed-back-on-itself, hexagonally tensed, embracing vectors, indicating a higher effectiveness of tensile integrity of Universe over any locally disintegrative forces. The comprehensive vector-equilibrium system would also have to recognize all the topological interpatterning characteristics and components; also, as a quasi-equilibrious system, all of its structural component vectors would have to be approximately the same length; therefore, all the interangulation would have to be in aberration increments relative to 60 degrees as the equilibrious norm.

420.05   The closest-packing-of-spheres model coincides with the observed real world's atomic packing of like atoms with their own counterparts.

420.06   We find that the space compartmentation formed by the vectors connecting the sphere centers always consists only of tetrahedra and octahedra. The spheres in closest packing coincide with the Eulerian vertexes; the vectors between the sphere centers are the Eulerian edges; and the triangles so formed are the "faces."

420.07   All of the polygons formed by the interacting vectors of the isotropic vector matrix consist entirely of equilateral triangles and squares. The squares occur as equatorial cross sections of the octahedra. The triangles occur as the external facets of both the tetrahedra and the octahedra.

420.08   All the polygons are reducible to triangles and are not further reducible. All polyhedra are reducible to triangulation, i.e., to trusses and are not further reducible. Infinite polyhedra are infinitely faceted by basic trusses.

421.00   Function of Nucleus in Isotropic Vector Matrix

421.01   Because the spacing of absolutely compacted spheres is tangential and hexagonal in great-circle cross section around any one sphere, the contact points are always spaced equidistant from the centers of the spheres and from their immediately neighboring points, respectively; wherefore the dimensions of a system of lines joining each and all adjacent spherical centers are identical to the universal radii of the identical spheres and, therefore, to each other. Such a universal system of identically dimensioned lines, growing outwardly from any one nuclear vertex, constitutes a universal vector system in dynamic equilibrium, for all the force lines are of equal magnitude.

421.02   In the isotropic vector matrix, every vector leads from one nuclear center to another, and therefore represents the operational effect of a merging of any two or more force centers upon each other. Each vector is composed of two halves, each half belonging respectively to any two adjacent nuclear centers Each half of the interconnecting vectors represents the radius of one of the two spheres tangent to one another at the vector midpoints.

421.03   Unity as represented by the internuclear vector modulus is of necessity always of the value of two, for it represents union of a minimum of two energy centers. (See Sec. 240.40.)

421.031   **Function of Nucleus in Isotropic Vector Matrix:** Every vector has two ends both of which join with other vectors to produce both structural systems and total cosmic integrity of regeneration. Every vector unites two ends.

421.04   Each nuclear ball can have a neutral function among the aggregates. It is a nuclear ball whether it is in a planar array or in an omnidirectional array. It has a unique function in each of the adjacent systems that it bonds.

421.05   The nucleus can accommodate wave passage without disrupting the fundamental resonance of the octaves. The tetrahedron is the minimum, ergo prime, non- nucleated structural system of Universe. The vector equilibrium is the minimum, ergo prime, nucleated structural system of Universe.

421.10   **Corollary:** Identically dimensioned nuclear systems and layer growths occur alike, relative to each and every absolutely compacted sphere of the isotropic vector matrix conglomerate, wherefore the integrity of the individual energy center is mathematically demonstrated to be universal both potentially and kinetically (Sec. 240.50).

421.20   **Ideal Vectorial Geometry of Nucleated Systems**

421.21   It is experientially suggested that the structural interpatterning principles apparently governing all atomic associability behaviors are characterized by triangular and tetrahedral accommodation, wherein the tetrahedron's six positive and six negative vectorial edge forces match a total of 12 universal degrees of freedom. The tetrahedron's exclusively edge-congruent-agglomeratability around any one nuclear point produces the vector equilibrium. These structural, pattern-governing, conceptualizable principles in turn govern all eternally regenerative design evolution, including the complex patterning of potential, symmetrically and asymmetrically limited, pulsative regenerations, only in respect to all of which are ideas conceivable. These patternings are experientially manifest in synergetics' closed-system topological hierarchy through which we can explore the ramifications of the idealistic vectorial geometry characteristics of inherently nucleated systems and their experientially demonstrable properties. (For possible relevance to the periodic table of the elements see Sec. 955.30.)

422.00   **Octet Truss**

422.01   In an isotropic vector matrix, there are only two clear-space polyhedra described internally by the configuration of interacting vectors: these are the regular tetrahedron and the regular octahedron operating as complementary space fillers. The single octahedron-tetrahedron deep truss system is known in synergetics as the *octet truss.*

422.02   The octet truss, or the isotropic vector matrix, is generated by the asymmetrical closest-packed sphere conglomerations. The nuclei are incidental.

422.03   When four tetrahedra of a given size are symmetrically intercombined by single bonding, each tetrahedron will have one of its four vertexes uncombined, and three combined with the six mutually combined vertexes symmetrically embracing to define an octahedron; while the four noncombined vertexes of the tetrahedra will define a tetrahedron twice the edge length of the four tetrahedra of given size; wherefore the resulting central space of the double-size tetrahedron is an octahedron. Together, these polyhedra comprise a common octahedron-tetrahedron system.

422.04   The tetrahedronated octahedron and all other regular symmetrical polyhedra known are described repetitiously by compounding two types of rational fraction asymmetric elements of the tetrahedron and octahedron. These elements are known in synergetics as the A and B Quanta Modules. (See Sec. 920.)

422.10   **Force Distribution:** In the three-way grid octet truss system, concentrated energy loads applied to any one point are distributed radially outward in nine directions and are immediately diffused into the finite hexagonally arranged six vectors entirely enclosing the six-way-distributed force. Each of the hexagon's six vertexes distribute the loads 18 ways to the next outwardly encircling vectors, which progressively diffusing system ultimately distributes the original concentrated energy force equally to all parts of the system as with a pneumatic tire. Thus the system joins together synergetically to distribute and inhibit the forces.

422.20   **Geometry of Structure:** Considered solely as geometry of structure, the final identification of the octet truss by the chemists and physicists as closest packing also identifies the octet truss and vector equilibria structuring as amongst the prime cosmic principles permeating and facilitating all physical experience.