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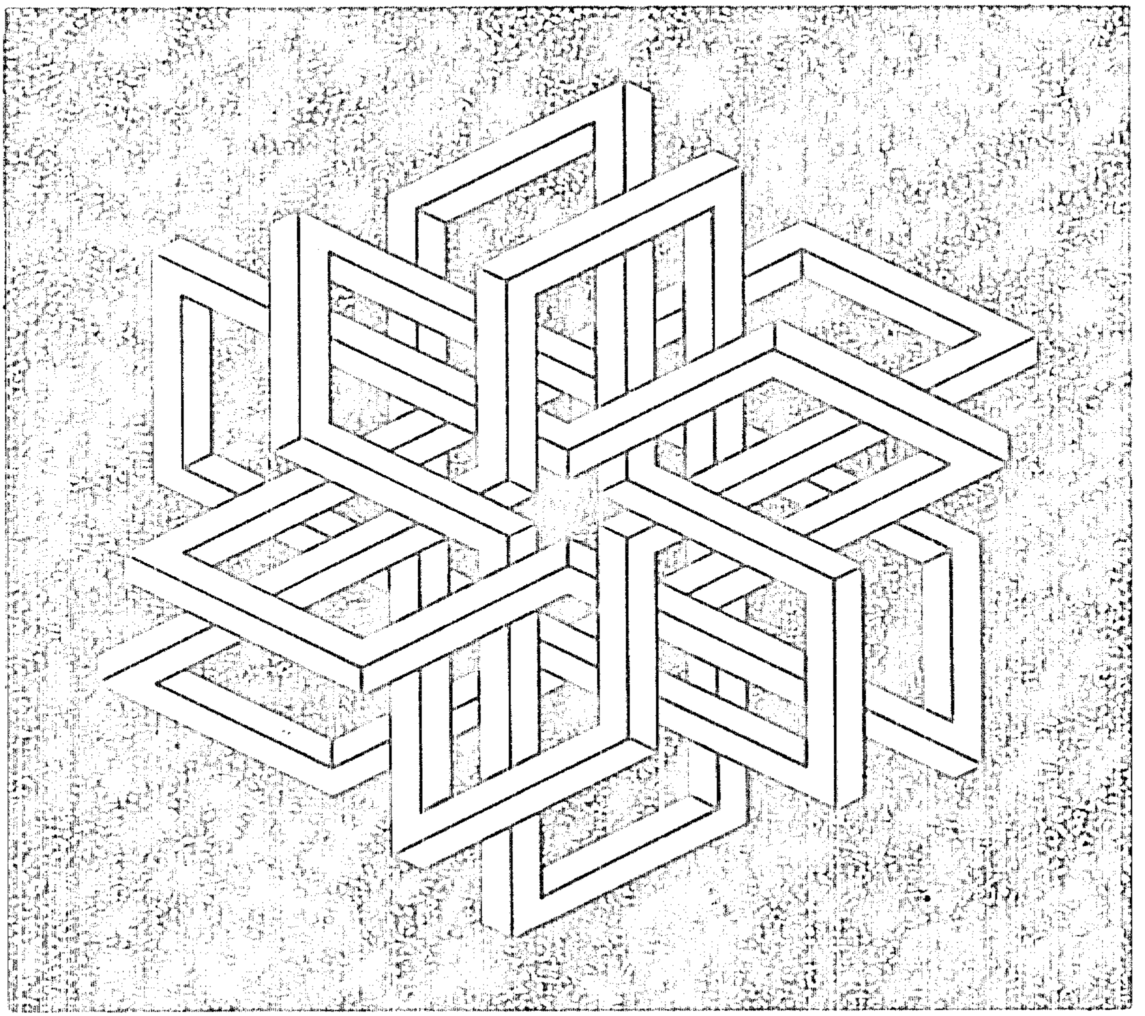

SYMMETRY IN SPHERICAL GRID SHAPING
PATTERN EXAMPLES OF SOME GEODESIC DOMES

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The sphere is a kind of surface which has an infinite number of symmetry axes and symmetry planes. This exceptional shape was in the past and still is used in the architecture of buildings of great cultural and social importance. Due to its curvatures the spherical surface has great rigidity and enables building light cover constructions of large spans. Dynamic development of metal constructions in architecture and engineering took place from the middle of the 19th century. Buckminster Fuller, an American architect and inventor, began in the 50s of the present century the development of geodesic domes of very interesting forms. This type of domes is characterized by a regular division of the sphere's surface. There are many types of spherical surface subdivisions (Spherical Grid Structures, 1987,pp. 161-182). Their essence depends on appropriate subdivision of chosen, repeatable parts of the sphere surface, most often in the form of equilateral or iscosceles triangles. Spherical triangular grids, obtained usually on the basis of regular polyhedrons, should consist of segments of

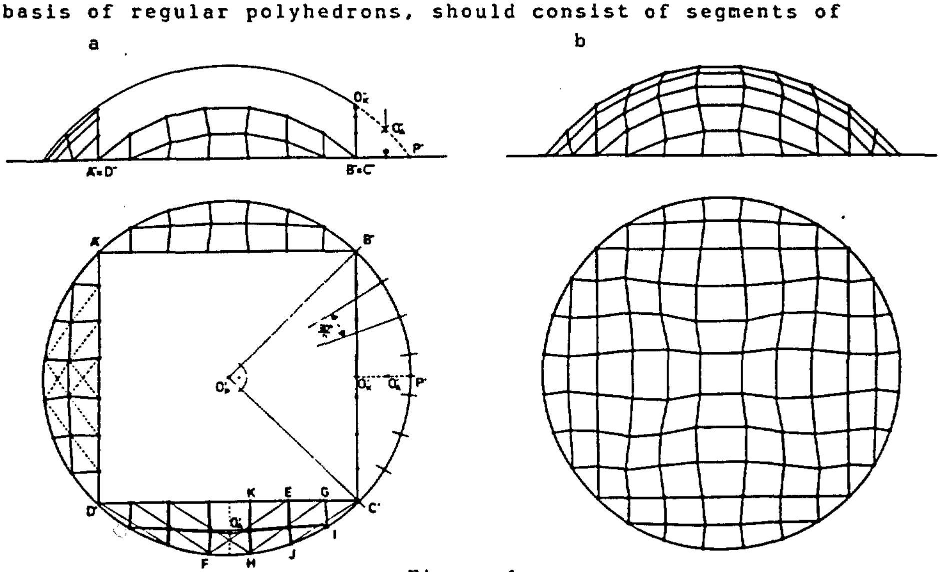

Figure 1

possible small differentiation of their lengths. It is advantegous when this grid consists of as small as possible number of segments of different length and the triangular faces between these segments should be of similar shape and similar surface field. A grid which is built of a small number of different triangular faces is very economical. Spherical grids of e.g. hexagonal or quadrangular patterns are determined on the basis of triangular grids by choosing appropriate segments running along the assumed directions.

The method of secondary grid deformation is one of the methods used in the determination of regular grids on the spherical surface. Its nature depends on the appropriate deformation of triangular, flat grid on the plane of the base and then the projection of this deformed grid onto the sphere surface. Due to its construction this method enables obtaining the smallest possible differentiation of segment lengths of the spherical grids. The method of secondary grid deformation can be considered as an important part of the theory of spherical grids shaping (An International Journal of Space Structures,1990,pp.197-212).

Figure 1 shows an example of possible applications of this method, using the properties of perpendicular projection onto the plane. There have been presented (see Fig.1a) schemes of node localization of the spherical grid onto the boundary areas of the spherical cap spaced over the circular form of the projection of the base. Figure 1b shows the pattern of a quadrangular spherical grid being the result of joining two procedures used in the method of secondary grid deformation (Space Structures of Large Span,1992).

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