Edwin KOŹNIEWSKI
Politechnika Białostocka
Wydział Budownictwa i Inżynierii Środowiska, Zakład Informacji Przestrzennej
ul. Wiejska 45E 15-351 Białystok
tel. 85 746 96 92/ fax: 85 746 95 59, e-mail: e.kozniewski@pb.edu.pl

APPLICATION OF OFFSETS IN GEOMETRIC CREATION OF ROOF SKELETONS

For a smooth planar curve c, we define an *offset* curve c_d ($c'_d \cup c''_d$) at distance d (for simplicity often just called an *offset*) in the following way: on each curve normal, we mark the two points that are at distance d from the curve c ([1], 335). The curves c'_d, c''_d will called half offsets.

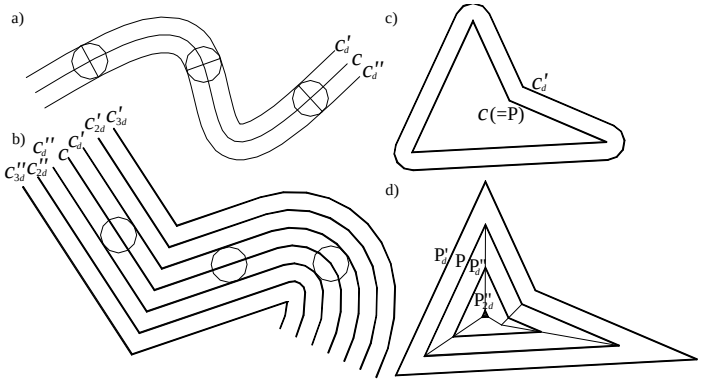

Fig. 1: Offsets of: a) a spline; b) a pline; c) a half offset of a polygon (obtained by means of AutoCAD with *Offsetgaptype*=1) d) a sequence of "half" discrete offsets of a polygon (obtained by means of AutoCAD with *Offsetgaptype*=0)

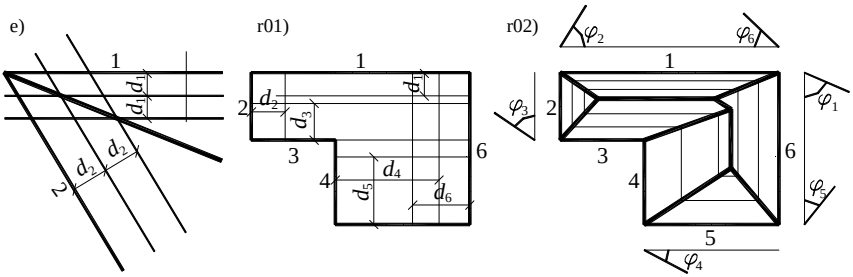

Fig. 2: Generalized discrete offsets: e) of an angle with d_1,d_2 parameters; data d_1,d_2,d_3,d_4,d_5,d_6 for a discrete offset of the polygon; r02) a sequence of "half" discrete offsets of a polygon (1,d_1; 2,d_2; 3,d_3; 4,d_4; 5,d_5; 6,d_6)

AutoCAD system provides alternatives for creating the offset of a planar polygon. Instead of replacing a vertex of a polygon **P** with a circular arc (cf. Fig.1c), the offset will have a sharp corner (cf. Fig.1d). Thus, the offset $\mathbf{P}_d$ (the so called discrete offset) of a polygon **P** is again a polygon. Figure 1d shows the sequence of "half" discrete offsets $\mathbf{P'}_d$, $\mathbf{P''}_d$.

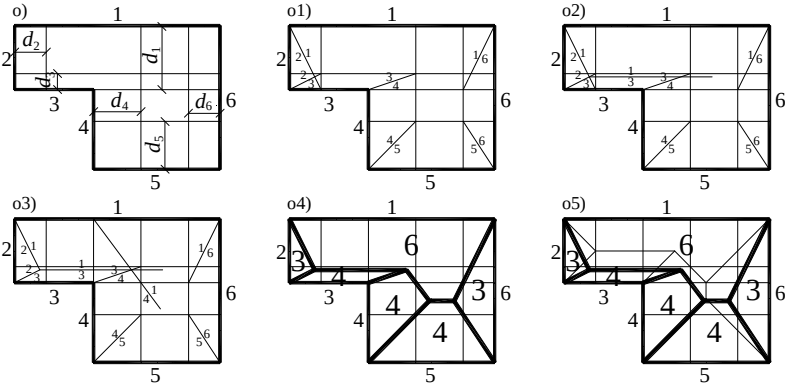

Fig. 3: Roof design for roof planes of different slope generated by a hexagon (1,d_1; 2,d_2; 3,d_3; 4,d_4; 5,d_5; 6,d_6) For an angle we can construct a discrete offset and define the so called (d_1,d_2)-*bisectrix* (cf. Fig.2e). Similarly for a given *n*-gonal polygon $\mathbf{P}_n$ and a sequence of real positive numbers (distances) $d_1,d_2,\ldots,d_n$ (satisfying certain constraints) we can construct the roof skeleton [2,3] of a roof spanned over the polygon $\mathbf{P}_n$. Such a construction allows to design roofs of varying slope (Fig.3).

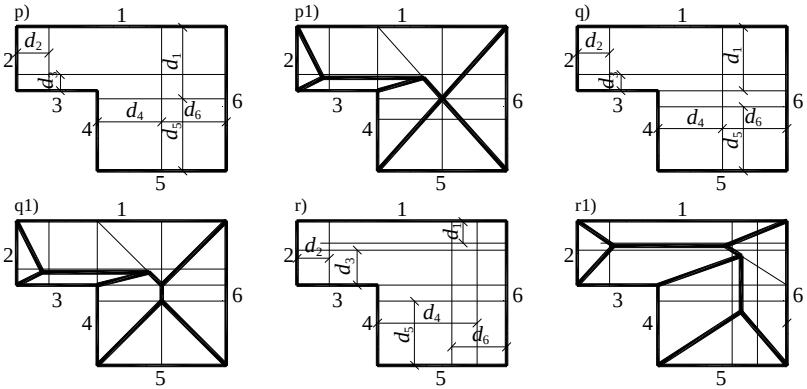

Fig. 4: Different topological kinds of roofs of varying slope generated by a hexagon (1,d_1; 2,d_2; 3,d_3; 4,d_4; 5,d_5; 6,d_6)

This paper discusses some properties of roof skeletons of roofs of varying slope. Particularly, the author shows that for an arbitrary fixed polygon we can obtain different shapes of roofs of varying slope depending on the sequence of real positive numbers (distances) $d_1,d_2,\ldots,d_n$ (cf. Fig.4).

Literature:

[1] Pottman H., et al.: *Architectural Geometry*. Bentley Institute Press. Exton, Pensylvania USA 2007.

[2] Koźniewski E.: *On the Existence of Shapes of Roofs*. Journal for Geometry and Graphics 8 (2004), No 2, 185-198.

[3] Koźniewski E.: *Geometry of Roofs. Theory and Application*. Wydawnictwo Politechniki Białostockiej. Białystok 2007(in Polish).