Vyacheclav MARTYNOV
Kremenchuk Mykhaylo Ostrogradskyi State Polytechnic University
20, Pershotravneva, Town of Kremenchuk, Poltava region, UKRAINE 39600
Phone: (38 05366) 74 33 08, e-mail: ddd151@yandex.ru

THT DETERMINATION OF OPTIMAL PROPORTIONS OF BUILDINGS

While planning the energy efficient and energy saving dwelling architectural objects which use solar energy for heating and hot water supply, the problem of heat loss reduction due to protecting structures and maximal use of solar energy through windows and protecting structures of the houses arises. It is possible using the selection of optimal proportions of the houses. The definition of proportions according to the different shape of designs provides the substantial reduction of heat loss and solar energy supply (up to 15 per cents).

One of the most distributed forms of house planning is rectangle (Figure 1). One side is *a*, and the other – a*m, the height of a house is *h*, the house cubic capacity *V*.

In order to determine optimal proportions of the houses (squared shape of designs) concerning heat loss, the formulae have been deduced which express the relation of optimal proportions (side *a*) on the house cubic capacity *V*, an average heat transfer resistance of protecting structures (walls R_{wall}, the ceiling $R_{ceiling}$, the windows R_{window}, the roof R_{roof}, an average coefficient of the floor R_{floor}), the number of floors in the house *N*, the correlation of the square of windows glassing to square of the floor of the storey (coefficient *F*), angle of slope of a house ceiling to the horizon square (angle α).

$$a = \sqrt[3]{\frac{V(1+m)}{R_{wall} m^2 \cdot \left[\frac{1}{R_{floor}} + \frac{1}{R_{roof} \cdot \cos\alpha} + F \cdot N \cdot \left(\frac{1}{R_{window}} - \frac{1}{R_{wall}} \right) \right]}} \quad , \tag{1}$$

where *m* is correlation of sides in the design.

The height of a house *h* is defined as

$$h = \frac{V}{a^2 \cdot m} \ . \qquad (2)$$

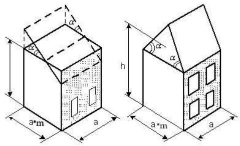

Figure 1

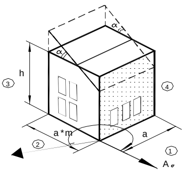

Figure 2

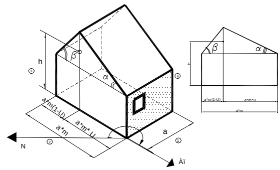

Figure 3

The optimal proportions of the house concerning heat input from solar radiation without taking into consideration windows and heat losses are defined as:

$$a = \sqrt[3]{\frac{V \cdot \left(I_{wall1} \cdot k_1 + I_{wall3} \cdot k_3 + \left(I_{wall2} \cdot k_2 + I_{wall4} \cdot k_4\right) \cdot m\right) \cdot \cos\alpha}{m \ \cdot I_{roof} \cdot k_{roof}}} \ ,$$

(3)

The height of a house *h* is defined as:

$$h = \frac{V}{a^2 m} . \qquad (4)$$

where I_{wall1}, I_{wall2}, I_{wall3}, I_{wall4} determine an average intensity of solar radiation during the heating period;

k_{floor} - the coefficient of relative intrusion of solar radiation heat on each of the walls (Figure 2).

$$k_n = \zeta_{window} \cdot \varepsilon_{window} \qquad (5)$$

As a result of studies the analytical dependences of definition of optimal proportions concerning solar radiation input and heat loss though protecting structures of the house have been deduced (Figure 2, 3).

The method of definition of optimal proportions for energy efficient dwelling houses with squared shape planning concerning the minimal heat losses and maximal heat input from solar radiation through protecting structures has been worked out (taking into account the supplemental indices).