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DIGITAL METHODS IN SOLVING OF THE ENGINEERING GRAPHICS PROBLEM

Digital methods predominate in information technology and graphical solving methods prevail in 2D-graphical disciplines (Engineering Graphics). Application of computer methods in graphics automatically forms contradiction unless graphics applies digital methods. The survey of the most related works [1-5] shows that information technology is applied as a new tool but not as a tool of the new generation. In a sense of graphics, information technology peculiarity lies in the fact that solving is made not by graphical methods (what is the basis of descriptive geometry), but by digital methods which are provided only graphically. Therefore, just in principle, graphical methods in information technology cannot be reasonable. On the other hand, although the real world is three-dimensional, modern picturing means (like a computer screen) are two-dimensional, so, operating geometrical-graphical information we have to solve transformation problems picturing that world and perceiving it in two-dimensional views.

To look for a reasonable solution becomes of topical interest, because such solution would enable to coordinate graphical way of presenting with digital solving methods. Here the propitious situation appears in surface modeling and development making. Thus, classical surface modeling formulae from theory become practical tools for surface making:

$$\Omega \{ 1 < G > [\, A \,] \};$$

where Ω - a surface, 1 - a surface element (a line, a straight line, a circle, any curve, etc.), in general-a generatrix; G – a graphical part, the whole of geometric elements, also called framework characteristics (prevailing, additional graphical elements: parallelism planes, regular generatrices centers, etc.); A – an algorithmic part, the order of geometric elements movement which implements specific surfaces. The formulae (and different formation ways) of the cylinder framework shown in Figure 1a would be the following:

$$\Omega_1 \{ 1 < i > [\, 1\, \psi\, i \,] \}; \Omega_2 \{ b < i > [\, b\, \psi\, i \,] \}$$

$$\Omega_3 \{ m < i > [\, C_{mi} \Rightarrow i \wedge C_{mi} \in i \,] \} \text{ or } \Omega_{3a} \{ 1 <m, i > [\, l_i \cap m, \; l_i /\!/ \; I \,] \}$$

$$\Omega_4 \{ 1 < m_i, m_n > [\, 1 \cap m_i, m_n \,] \}$$

According to classical graphics formulae and applying different rational ways digital methods enable not only to make surfaces but also receive the developments of those surfaces applying an inverse operation. The cylinder surface made in this way (Fig. 1a) can be transformed into a development by uncoiling (Fig. 1b). It is convenient to make surface objects developments necessary for engineering experience (drainpipes, ventilation canals, etc.) which can be received automatically having space objects.

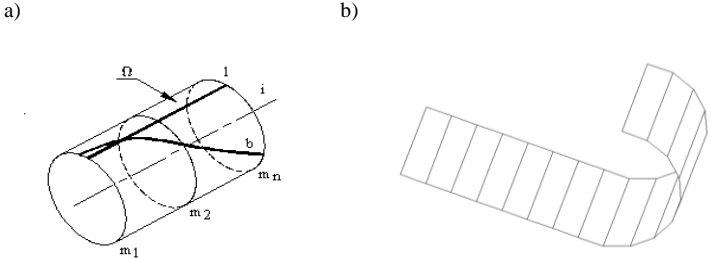a)   b)

Figure 1. Surface Modelling
a – engineering surfaces, b – surface uncoiling

Uncoiling method [6], which means consequent superposing of forming planes (manipulating their coordinates and elementary rotating command by digital method), enables to develop exotic for engineering architectural forms (Fig. 2a) objects.

Figure 2. Digital Methods Experience
a – model, b – developments

Computer-aided surface modeling acquired new aspects compared with classical graphics as it transformed from apparent in paper technologies into quasi-real, digital, automatically analyzed and processed. Surface developments can be received automatically or interactively controlling the process.

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