Introduction

CAD systems use is one of the perspective directions of architect professional activity intensification. Moreover both hardware and software, which ensure the integral whole of the architect/computer interaction in the traditional for the designer form of creative activity results representation (i.e. as graphic or volumetric models) have the greatest opportunities. However, if in the field of a computer aided graphic modelling a lot of virtual reality developments allowing to some reliability present the design decision has appeared recently, in the field of architectural objects volumetric modelling (prototyping) the automation makes only first steps. At the same time even in conditions of a complex computerisation of professional architectural activity the scale model is, as a matter of fact, only one real three-dimensional representation of projected object (in contrast to «conditional three-dimensional» graphic images). Besides during designing the offered design decision estimation (including expert one) is necessary, which often is carried out by the overlapping both design (computer, model) and real (represented by video plots) spaces. The development of the effective automated technologies at the end of 1980-th has resulted in occurrence essentially of new class of the industrial equipment – manufacturing systems of «Rapid Prototyping», allowing to make the products of complex volumetric form in the automated mode (Kruth, 1991). The experience of effective application of the similar equipment in some areas of design creativity (for example in automobile design) is already known (Lukas, 1990; Mitchell and McCullough, 1994; Rees, 1999).

The researches in the field of the automated prototyping of architectural objects are in a stage of intensive development (Svirska et al, 1991). The specificity of features of design modelling methods and means used in modern architectural practice causes the elements of the automated prototyping and video-computer technologies inclusion in design process, first of all for check of volumetric representation correctness of future object and the opportunity of physical realisation consequently. The assumption of an opportunity of effective application of the automated prototyping for physical representation of CAD results at different stages of architectural designing is accepted as a working hypothesis. So a scale model of the famous Chapel in Rhonshane was...
made by SLA-technology for examination of a principal possibility of RP using in the architectural design modelling (Figure 1) and than an area of rational application RP in the architectural scale modelling was determinate. Therefore the purpose of research consist in the definition of area and way of application of the automated prototyping during designing architectural objects.

Aims and technique of the research

According to this purpose in work the following tasks are solved:

1. To analyse the techniques of design modelling and to reveal the basic requirements to means of designing.
2. To determine the modern conditions in aspect of the automated prototyping application in architectural designing.
3. To establish the objective geometrical characteristics of the form of architectural objects and their scale models.
4. To formulate a criterion and to develop a technique for an estimation of complexity of the geometrical form of architectural object and its scale model.
5. To synthesise a complex criterion for an estimation of efficiency of a model method taking into account morphology of object and technical and economic parameters of design process.
6. To develop a technique of the comparative analysis of methods of architectural objects prototyping.
7. To determine an area of rational application of the automated prototyping and to develop the recommendations for prototyping architectural objects.

By considering the designing as the process of creative transformation of design models with consecutive specification and detailed elaboration of their description, the requirement of obvious presentation (i.e. insuring of ease and simplicity of perception) of the designed object figurative decision is revealed as the basic requirement to means of designing. The most evident model of projected object is its volumetric physical model – scale model.

The system analysis of a history and urgent tendencies of development of a model method of professional architectural designing has allowed to determine modern conditions of wide introduction of CAD systems as favourable for perfection of prototyping means by their effective automation.

Is established that morphological aspect (as a designing object spatial configuration description) of the «architectural form» concept multilevel organisation, which based on the objective geometrical properties of architectural object lay, is basic for definition of efficiency of prototyping methods.

The technique of a qualitative estimation of complexity of the geometrical form is developed. The level of complexity of the geometrical form of object and its scale model is determined by a kind of forming surfaces and their quantity.

The technique of the two-stage collective expert analysis of efficiency of the architectural
Table 1. Results of the analysis of the architectural objects form complexity and RP application areas.
objects automated prototyping is developed with use of four criteria which characterise an object morphology and technical and economic parameters of prototyping process. The complexity of the geometrical form of object as well as accuracy, efficiency and cost of prototyping are accepted as criteria of efficiency.

The methodological base for development of the concrete recommendations on application of a model method in system of the automated architectural designing is created. The conformity of the architectural object to a typical level of complexity of its spatial form is determined on the basis of developed applied typology of architectural objects and levels of geometric complexity of their concrete kinds.

The obtained results discussion

The degree of efficiency of the automated prototyping application in professional architectural designing is determined and shown in table 1.

Conclusion

The researches, carried out by the author, have allowed to determine the area of automated prototyping effective application in particular by dividing the objects of the architectural designing on three groups:

1) The group of objects, which automated prototyping is urgent and it is already effective nowadays;
2) The group of objects, which automated prototyping is perspective in the nearest future;
3) The group of objects, which automated prototyping while is not expedient economically.

References
