

## COMBINED APPLICATION OF PHYSICAL AND NUMERICAL MODELLING IN HYDRAULIC RESEARCH

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The Paper presents general principals of hydraulic research with combined application of physical and numerical modelling (“hybrid” or coupled modelling). It is corroborated the fact that at present, in spite of constantly increasing resources of numerical modelling, the application of physical modelling is essential and helpful element of rather complicated hydraulic research. There are stated the considerations about distribution of functions between physical and numerical modelling during their combined application.

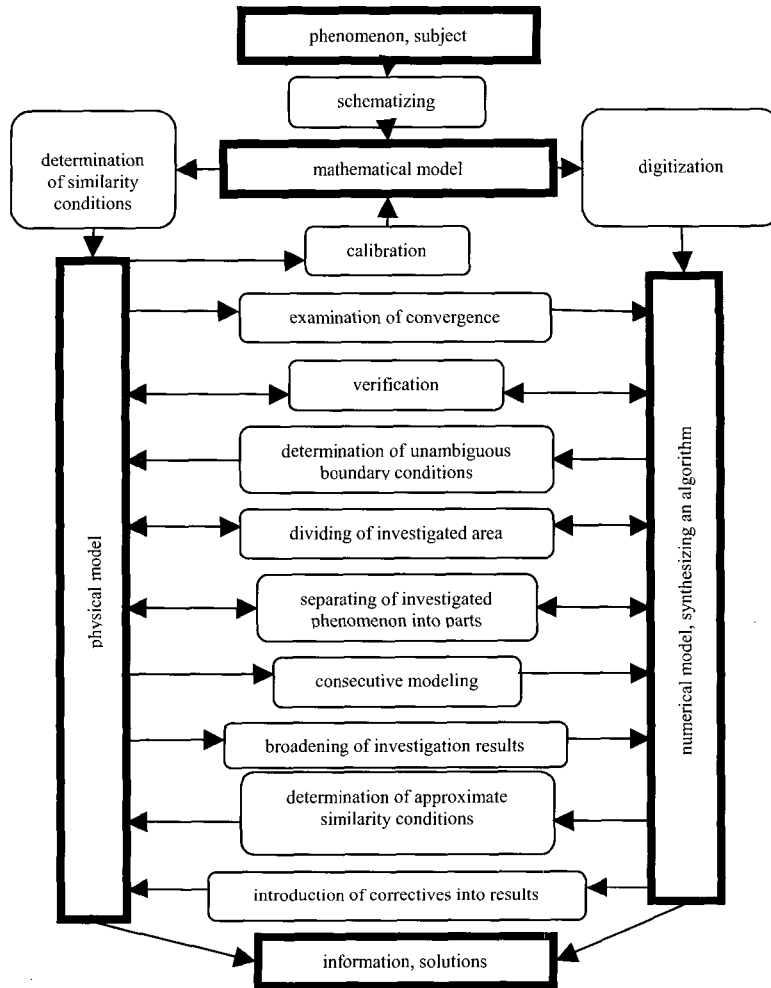
Solution of appropriate mathematical problem could be obtained by different methods. However, for solution of more or less complicated problems usually it is necessary to apply numerical or subject modelling (physical one in case of hydraulic research). Essential advantage of physical modelling lies in possibility to solve problems even in cases that the mathematical model is formulated not fully. Another advantage of physical modelling lies in comparative simplicity of imposing complicated boundary conditions.

Of prime importance are principle limitations on potentiality of modelling methods: incompatibility of similarity conditions for physical modelling and openness of the set of equations constituted a mathematical model for numerical modelling. There are numerous practical advantages of one modelling method over another one. These facts provide reason to use one or other modelling method in each specific investigation [1].

Significant advances of recent years in the numerical modelling, progress in computers potentiality increase and cost reduction seemingly should have ousted physical modelling from investigation process. However, modern practice of hydraulic research demonstrates importance of physical modelling today. International hydraulic community clearly developed opinion of advisability to use both discussed modelling methods for complex problems within a single investigation [2, 3, and 4].

We suggested [1] to use the term “hybrid modelling” being applied to whole hydraulic investigation process with combined use of both physical and numerical modelling. This synergism secures the achievement of a number of goals. Basic investigation scheme with hybrid modelling is shown below.

According to this scheme physical and numerical modellings may be successfully jointly used to solve complicated hydraulic problems. The Paper presents examples of hybrid modelling application for determination of specific problems



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