HYDROINFORMATICS

M.B. Abbott
International Institute for Hydraulic and Environmental Engineering (IHE), Delft, The Netherlands

Keywords: Hydraulics, hydroinformatics, hydraulic engineering, graphical interfacing, knowledge processors, numerical continuum, numerical modeling

Contents

1. Introduction
2. The Hydraulic Engineer in the Postsymbolic Era
3. Tool Builders and Tool Users
4. Fact Engines and Judgment Engines
5. The Change in Paradigm at the Level of the Numerical-Hydraulic Model
6. The Technologies of Persuasion
7. The Widening Scope of Application of Hydraulics Knowledge
8. The Technological Service Provider (STP)
Glossary
Bibliography
Biographical Sketch

Summary

The article gives an overview on the development of hydraulic and hydrologic information systems from early graphical and numerical databanks to present-day computer-driven networks. The various stages of development, keeping pace with the advent of more and more advanced computing technology and data storage and retrieval capacity, are outlined. A philosophical view is presented for dealing with information from the broadest to the most detailed methods for developing robust models for system analysis and prognosis.

1. Introduction

Hydroinformatics is the study of the flows of knowledge and data related to the flow of water and all that it transports, together with interactions with both the natural and the manmade, or artificial, environments. Hydraulics, understood as the study of flows of water, and more extended to include the transport of matter in all its forms within flows, is accordingly central to hydroinformatics. Without hydraulics there cannot be hydroinformatics.

It might at first appear as though hydroinformatics provides only a new periphery to hydraulics: a new way of transmitting hydraulics knowledge and data to society. In practice, however, the way in which hydraulics is viewed and practiced is itself changing as a result of its incorporation into the new paradigm that hydroinformatics provides. The first objective of this article is to introduce some of the changes that are proceeding in hydraulics under the influence of developments occurring in
hydroinformatics. The second objective is to indicate the consequences of these changes for the direction of development of hydraulics itself (see Fluid Mechanics).

2. The Hydraulic Engineer in the Postsymbolic Era

The first and most obvious change that has occurred in hydraulic engineering is the way in which hydraulic engineers work. Like most other engineers, the hydraulic engineer, in large part, and in many cases for the most part, works through the graphical user interface of a computer and its associated network.

The era in which the engineer worked with symbols, making calculations directly from equations and the curves of the graphs of such equations, is mostly over. The engineer works mainly with signs. Whereas the symbols of an earlier era replaced the world in the mind of the engineer, at least while he or she manipulated these symbols, the signs of the graphical user interface point toward the world in the mind of the engineer (see Measurement of Free-Surface Flow).

More basically, while in the earlier era the engineer was a repository of knowledge made expressible in symbols, that is a knower, the engineer is now primarily a repository of the sum of all the means to access knowledge, so that he or she is primarily a consumer of knowledge made expressible in signs. Correspondingly, the device that was previously a computer, as a means of making computations, now becomes a knowledge processor, as a means of manipulating knowledge; and what was previously a data network, as a means merely of accessing data, now becomes an intranet, or even an extranet, as a device for communicating knowledge in the first place and data only in the second place. This new era, in which the engineer no longer works with symbols in the capacity of a knower, but instead works with signs in the capacity of a consumer of knowledge, is quite generally called the postsymbolic era (see Probabilistic Methods and Stochastic Hydrology).

3. Tool Builders and Tool Users

Corresponding to this change in the status of the engineer, and indeed in the status of all knowledge users, a division occurs between, on the one hand, those who produce, encapsulate, market, broker, and transmit knowledge and, on the other hand, those who access and use this knowledge. The equipment whereby knowledge is transferred belongs to the category of tools, so that one can identify here a division between tool builders and tool users.

Now, any theoretical discussion (let alone “a theory”) of this process of using equipment presents a special problem, which Heidegger long ago identified as follows: The kind of being which equipment possesses—in which it manifests itself in its own right—can be called readiness-to-hand. Only because equipment has this “being-in-itself” and does not merely occur, is it manipulatable in the broadest sense and at our disposal. No matter how sharply one just looks at the “outward appearance” of things in whatever form this takes, one cannot discover anything ready-to-hand. If one looks at things just “theoretically,” one can get along without understanding readiness-to-hand.
But when dealing with them by using them and manipulating them, this activity is not a blind one; it has its own kind of sight by which one’s manipulation is guided and from which it acquires its specific thingly character. Dealings with equipment subordinate themselves to the manifold assignments of the “in-order-to.” And the sight with which they accommodate themselves is circumspection.

Thus, the interface across which almost all knowledge flows between the toolmaker and the tool user is one that functions most immediately, but then almost exclusively, through the faculty of sight, through the graphical user interface (GUI).

Bibliography


**Biographical Sketch**

**Michael Abbott** is a specialist hydraulic and environmental research engineer who was responsible for the development of the science of hydroinformatics. He has developed scientifically based numerical computing programs for determining flow behavior in one to three dimensions and has applied this to consulting service practice dealing with complex flow problems and their analysis worldwide. He is associated with the IHE, the International Institute for Hydraulic and Environmental Engineering, situated in Delft, The Netherlands.