

ESTIMATION OF SELF-PURIFICATION OF POLLUTED RIVERS BASED ON THE STABLE WATER QUALITY EQUATIONS

AKIRA OHSUMI, MASATAKA KASHIWAGI, MASAHIKO WATANABE

Department of Mechanical & System Engineering
Graduate School of Science and Technology
Kyoto Institute of Technology
Matsugasaki, Sakyo, Kyoto 606-8585, Japan
ohsumi@kit.ac.jp

TOMOJI TAKATSU

Echigo Hillside, National Government Park Office
Hokuriku Regional Development Bureau
Ministry Land Infrastructure and Transport
Aobadai 1, Nagaoka, Niigata 940-2145, Japan

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ABSTRACT. *An estimation problem of water quality of a river is considered. The BOD (biochemical oxygen demand) and DO (dissolved oxygen) are regarded as two major quantities to investigate the water quality. First, based on the couple of steady-state transport equations for substance concentrations, the stable water quality equations are derived, and then the state space representation is obtained. By formulating the observation process from which the observation data on the BOD and DO are measured, the Kalman filter is derived. Finally, simulation studies are presented.*

Keywords: Water quality equation, BOD, DO, Self-purification, Kalman filter

1. Introduction. Nowadays the environmental problem is recognized worldwide as one of problems to be solved urgently in order to maintain our comfortable life. Specifically, the water quality management is one of the most important subjects. For the analysis of self-purification of water quality of a river, the most famous mathematical model was launched first by Streeter and Phelps in 1925 [1], giving their attention to BOD (biochemical oxygen demand) and DO (dissolved oxygen). From that time down to this day, several mathematical models have been proposed to describe the response of pollution bodies in water, and many researches have been developed (e.g., see [2-4]). Especially, in Japan, two serial research projects on the environmental engineering for rivers were conducted under the control of the Ministry of Education during 1987-92, and their fruits were published in books [5, 6].

As well-known, there are several indices such as pH, BOD, DO, COD (chemical oxygen demand), etc. for showing pollution levels of a river. Among them, the indices BOD and DO are considered to be exceptionally important because BOD and DO are two major indices for life in the water to survive. So, in this paper these two are employed as indices of water quality of a river as Streeter and Phelps did. Although the Streeter-Phelps water quality model can be applied to such long, gentle rivers flowing through the Continent, it is