Civil Engineering Hydraulics and Engineering Hydrology

Dr. Tanjina Nur, Ph.D.

ArclerPress

Civil Engineering Hydraulics and Engineering Hydrology

The objective of this book is to give knowledge of open channel hydraulics and hydrology, leading to understanding of the scientific foundations and basic principles of these fields, and the ability to apply hydraulic and hydrological methods to engineering applications in an integrated way. The first part of the book describes an assessment of the literature and recent developments on the shallow wake in an open channel flow and secondary currents and turbulence over a non-uniformly roughened open-channel bed. Then we present flow patterns in an open channel confluence with increasingly dominant tributary inflow and a novel approach for estimating the recurrence intervals of channel-forming discharges. After that, we try to find the effect of the hydraulic retention time on the performance of an ecological wastewater treatment system with a constructed wetland and rehabilitation priority determination of water pipes based on hydraulic importance. In the middle part of the book, we focus on the effect of hydraulic characteristics on algal bloom in an artificial seawater canal of South Korea and improvement of hydraulic and water quality renovation functions by intermittent aeration of soil treatment areas in onsite wastewater treatment systems. Determination of watershed infiltration and erosion parameters from field rainfall simulation analyses and the Influence of statistical uncertainty in the hydraulic boundary conditions on the probabilistically computed high water level frequency curve are also discussed. Then we present pollutant removal and hydraulic reduction performance of field grassed swales during runoff simulation experiments and an approach using a 1D hydraulic model, landsat imaging and generalized likelihood uncertainty estimation for an approximation of flood discharge. At the end, we try to describe rainfall variability in the watershed and its relationship with ENSO and micro radar surface velocimetry for hydrologic signal processing using a filtering approach. Also impact of climate change on groundwater resources in the Southern Mali and physical vulnerability assessment based on fluid and classical mechanics to support cost-benefit analysis of flood risk mitigation strategies are also discussed. Then modified lane's relation in local bed scouring studies in the laboratory channel and wave and hydrodynamic modelling for engineering design of Jetties at Tangier Island is presented briefly.

Tanjina finished her PhD in Civil and Environmental Engineering in 2014 from University of Technology Sydney (UTS). Now she is working as Post-Doctoral Researcher in the Centre for Technology in Water and Wastewater (CTWW) and published about eight International journal papers with 80 citations. Her research interest is wastewater treatment technology using adsorption process.

ArclerPress

ISBN 978-1-68094-381-8

Nur

Civil Engineering Hydraulics and Engineering Hydrology

ArclerPress

Civil Engineering Hydraulics and Engineering Hydrology

Editor:

Dr. Tanjina Nur, Ph.D.

ArclerPress

www.arclerpress.com

Civil Engineering Hydraulics and Engineering Hydrology

Editor: Dr. Tanjina Nur, Ph.D.

© 2017 Arcler Press LLC
708 3rd Avenue, 6th Floor
New York
NY 10017
United States of America
www.arclerpress.com

ISBN: 978-1-68094-381-8

Library of Congress Control Number: 2016951069

This book contains information obtained from highly regarded resources. Reprinted material sources are indicated. Copyright for individual articles remains with the authors as indicated. A Wide variety of references are listed. Reasonable efforts have been made to publish reliable data and views articulated in the chapters are those of the individual contributors, and not necessarily those of the editors or publishers. Editors or publishers are not responsible for the accuracy of the information in the published chapters or consequences of their use. The publisher believes no responsibility for any damage or grievance to the persons or property arising out of the use of any materials, instructions, methods or thoughts in the book. The editors and the publisher have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission has not been obtained. If any copyright holder has not been acknowledged, please write to us so we may rectify.

Notice: Registered trademark of products or corporate names are used only for explanation and identification without intent of infringement.

Arcler Press LLC publishes wide variety of books and eBooks. For more information about Arcler Press and its products, visit our website at www.arclerpress.com

此为试读，需要完整PDF请访问：www.ertongbook.com

Civil Engineering Hydraulics and Engineering Hydrology

About the Editor

Dr. Tanjina Nur, Ph.D.

Tanjina finished her PhD in Civil and Environmental Engineering in 2014 from University of Technology Sydney (UTS). Now she is working as Post-Doctoral Researcher in the Centre for Technology in Water and Wastewater (CTWW) and published about eight International journal papers with 80 citations. Her research interest is wastewater treatment technology using adsorption process.

List of Contributors

Arindam Singha
Mechanical Engineering Department, Texas A&M University at Qatar, Doha 77844, Qatar

Ramaswami Balachandar
Civil Engineering Department, University of Windsor, Windsor, ON, Canada N9B 3P4

Thorsten Stoesser
School of Engineering, Cardiff University, Cardiff CF24 3AA, UK

Richard McSherry
School of Engineering, Cardiff University, Cardiff CF24 3AA, UK

Bruno Fraga
School of Engineering, Cardiff University, Cardiff CF24 3AA, UK

Laurent Schindfessel
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, St-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium

Stéphan Creëlle
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, St-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium

Tom De Mulder
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, St-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium

Andy Ward
Department of Food, Agricultural and Biological Engineering, The Ohio State University, Columbus, OH 43210, USA

Molly Moran
Department of Civil, Environmental and Geodetic Engineering, The Ohio State University, Columbus, OH 43210, USA

María L. Merino-Solís
Environmental Technology, Research Center and Assistance in Technology and Design of Jalisco, N.P.O., Normalistas 800, Guadalajara 44270, Jalisco, Mexico

Edgardo Villegas
Environmental Technology, Research Center and Assistance in Technology and Design of Jalisco, N.P.O., Normalistas 800, Guadalajara 44270, Jalisco, Mexico

José de Anda
Environmental Technology, Research Center and Assistance in Technology and Design of Jalisco, N.P.O., Normalistas 800, Guadalajara 44270, Jalisco, Mexico

Alberto López-López
Environmental Technology, Research Center and Assistance in Technology and Design of Jalisco, N.P.O., Normalistas 800, Guadalajara 44270, Jalisco, Mexico

Do Guen Yoo
Research Center for Disaster Prevention Science and Technology, Korea University, Seoul 136-713, Korea

Doosun Kang
Department of Civil Engineering, Kyung Hee University, 1732 Deogyeong-daero, Giheung-gu, Yongin-si 446-701, Gyeonggi-do, Korea

Hwandon Jun
Department of Civil Engineering, Seoul National University of Science and Technology, 172, Gongreung 2-dong, Nowon-Gu, Seoul 139-743, Korea

Joong Hoon Kim
School of Civil, Environmental and Architectural Engineering, Korea University, Anam-ro 145, Seongbuk-gu, Seoul 136-713, Korea

Seung Oh Lee
Department of Urban & Civil Engineering, Hongik University, 72-1 Sangsu-dong Mapo-gu, Seoul 121-791, Korea

Sooyoung Kim
Department of Urban & Civil Engineering, Hongik University, 72-1 Sangsu-dong Mapo-gu, Seoul 121-791, Korea

Moonil Kim
Department of Civil and Environmental Engineering, Hanyang University, Ansan 426-791, Korea

Kyoung Jae Lim
Department of Regional Infrastructural Engineering, Kangwon National University, Chuncheon 200-701, Korea

Younghun Jung
Department of Regional Infrastructural Engineering, Kangwon National University, Chuncheon 200-701, Korea

José A. Amador
Department of Natural Resources Science, Coastal Institute-Kingston, University of Rhode Island, Kingston, RI 02881, USA

David A. Potts
Geomatrix, LLC, 114 Mill Rock Road East, Old Saybrook, CT 06475, USA

George W. Loomis
New England Onsite Wastewater Training Program, Coastal Institute-Kingston, University of Rhode Island, Kingston, RI 02881, USA

David V. Kalen
New England Onsite Wastewater Training Program, Coastal Institute-Kingston, University of Rhode Island, Kingston, RI 02881, USA

Erika L. Patenaude
Department of Natural Resources Science, Coastal Institute-Kingston, University of Rhode Island, Kingston, RI 02881, USA

Josef H. Görres
Department of Natural Resources Science, Coastal Institute-Kingston, University of Rhode Island, Kingston, RI 02881, USA

Mark E. Grismer
Hydrologic Sciences and Biological & Agricultural Engineering, UC Davis, Davis, CA 95616, USA

Hua Zhong
Nanjing Hydraulic Research Institute, Nanjing 210029, China
State Key Laboratory of Hydrology–Water Resources and Hydraulic Engineering, Nanjing 210098, China

Pieter van Gelder
Safety and Security Science Group, Faculty of Technology, Policy and Management, Delft University of Technology, Delft 2628 BX, The Netherlands

Wen Wang
State Key Laboratory of Hydrology–Water Resources and Hydraulic Engineering, Nanjing 210098, China
College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China

Gaoxu Wang
Nanjing Hydraulic Research Institute, Nanjing 210029, China

此为试读,需要完整PDF请访问: www.ertongbook.com

State Key Laboratory of Hydrology–Water Resources and Hydraulic Engineering, Nanjing 210098, China

Yongzhi Liu
Nanjing Hydraulic Research Institute, Nanjing 210029, China
State Key Laboratory of Hydrology–Water Resources and Hydraulic Engineering, Nanjing 210098, China

Shuai Niu
Nanjing Hydraulic Research Institute, Nanjing 210029, China
State Key Laboratory of Hydrology–Water Resources and Hydraulic Engineering, Nanjing 210098, China

Terry Lucke
Stormwater Research Group, School of Engineering, Faculty of Science and Engineering, University of the Sunshine Coast, Warana, QLD 4558, Australia

Mohamed Ansaf Kachchu Mohamed
Stormwater Research Group, School of Engineering, Faculty of Science and Engineering, University of the Sunshine Coast, Warana, QLD 4558, Australia

Neil Tindale
Stormwater Research Group, School of Engineering, Faculty of Science and Engineering, University of the Sunshine Coast, Warana, QLD 4558, Australia

Younghun Jung
Department of Civil Engineering, Inha University, 100 Inha-ro, Nam-gu, Incheon 402-751, Korea

Venkatesh Merwade
School of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN 47907, USA

Kyudong Yeo
Department of Civil Engineering, Inha University, 100 Inha-ro, Nam-gu, Incheon 402-751, Korea

Yongchul Shin
Department of Biological & Agricultural Engineering, Texas A&M University, College Station, TX 77843, USA

Seung Oh Lee
School of Urban and Civil Engineering, Hongik University, Seoul 121-791, Korea

Thelma Dede Baddoo
State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China

Yiqing Guan
State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China
College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China

Danrong Zhang
State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China
College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China

Samuel A. Andam-Akorful
School of Earth Sciences and Engineering, Hohai University, Nanjing 210098, China
Department of Geomatic Engineering, Kwame Nkrumah University of Science and Technology, Private Mail Box, Kumasi, Ghana

Jeng-Wen Lin
Department of Civil Engineering, Feng Chia University, Taichung 40724, Taiwan

Chih-Wei Huang
Ph.D. Program in Civil and Hydraulic Engineering & Research Center for Science and Technology across the Taiwan Strait, Feng Chia University, Taichung 40724, Taiwan

Yin-Sung Hsu
Department of Water Resources Engineering and Conservation, Feng Chia University, Taichung 40724, Taiwan

Adama Toure
Graduate Research Program on Climate Change and Water Resources, West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), Department of Applied Hydrology, University of Abomey-Calavi, Cotonou, Abomey-Calavi BP 2008, Benin

Bernd Diekkrüger
Department of Geography, University of Bonn, Bonn 53115, Germany

Adama Mariko
Department of Geology, National Engineer School, Bamako BP 242, Mali

Bruno Mazzorana
Department of Hydraulic Engineering—Abteilung Wasser Schutzbauten, Autonomous Province of Bolzano, Italy, Cesare Battisti Street 23, Bolzano 39100, Italy
Faculty of Science and Technology, Free University of Bolzano, Universitätsplatz 5, Bolzano 39100, Italy

Laura Levaggi
Faculty of Science and Technology, Free University of Bolzano, Universitätsplatz 5, Bolzano 39100, Italy

Omar Formaggioni
Department of Hydraulic Engineering—Abteilung Wasser Schutzbauten, Autonomous Province of Bolzano, Italy, Cesare Battisti Street 23, Bolzano 39100, Italy

Claudio Volcan
Department of Hydraulic Engineering—Abteilung Wasser Schutzbauten, Autonomous Province of Bolzano, Italy, Cesare Battisti Street 23, Bolzano 39100, Italy

Marta Kiraga
Water Engineering Division, Department of Hydraulic Engineering, Warsaw University of Life Sciences—SGGW, 159 Nowoursynowska Street, Warsaw 02-787, Poland

Zbigniew Popek
Water Engineering Division, Department of Hydraulic Engineering, Warsaw University of Life Sciences—SGGW, 159 Nowoursynowska Street, Warsaw 02-787, Poland

Lihwa Lin
Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180, USA

Zeki Demirbilek
Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180, USA

Donald Ward
Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180, USA

David King
Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180, USA

Preface

The objective of this book is to give knowledge of open channel hydraulics and hydrology, leading to understanding of the scientific foundations and basic principles of these fields, and the ability to apply hydraulic and hydrological methods to engineering applications in an integrated way. The first part of the book describes an assessment of the literature and recent developments on the shallow wake in an open channel flow and secondary currents and turbulence over a non-uniformly roughened open-channel bed. Then we present flow patterns in an open channel confluence with increasingly dominant tributary inflow and a novel approach for estimating the recurrence intervals of channel-forming discharges. After that, we try to find the effect of the hydraulic retention time on the performance of an ecological wastewater treatment system with a constructed wetland and rehabilitation priority determination of water pipes based on hydraulic importance.

In the middle part of the book, we focus on the effect of hydraulic characteristics on algal bloom in an artificial seawater canal of South Korea and improvement of hydraulic and water quality renovation functions by intermittent aeration of soil treatment areas in onsite wastewater treatment systems. Determination of watershed infiltration and erosion parameters from field rainfall simulation analyses and the Influence of statistical uncertainty in the hydraulic boundary conditions on the probabilistically computed high water level frequency curve are also discussed. Then we present pollutant removal and hydraulic reduction performance of field grassed swales during runoff simulation experiments and an approach using a 1D hydraulic model, landsat imaging and generalized likelihood uncertainty estimation for an approximation of flood discharge.

At the end, we try to describe rainfall variability in the watershed and its relationship with ENSO and micro radar surface velocimetry for hydrologic signal processing using a filtering approach. Also impact of climate change on groundwater resources in the Southern Mali and physical vulnerability assessment based on fluid and classical mechanics to support cost-benefit analysis of flood risk mitigation strategies are also discussed. Then modified lane's relation in local bed scouring studies in the laboratory channel and wave and hydrodynamic modelling for engineering design of Jetties at Tangier Island is presented briefly.

Editor
Dr. Tanjina Nur, Ph.D.

INTRODUCTION

Civil engineering is one of the oldest engineering disciplines, since civil engineers of one form or another have been around ever since humans started building major public works such as roads, bridges, tunnels, and large public buildings. It is also an incredibly broad discipline, spanning treatment of environmental issues, transportation, power generation, and major structures. To become a civil engineer, a person must typically study engineering at a university and then participate in field work for practical training. Many nations also require that students pass a competency exam to ensure that they will be able to design and build safe, stable structures.

There are many branches of civil engineering, and a wide range of specialties. Some engineers focus on conception and initial design of a project, analyzing the site, the needs, and the resources to come up with a workable project plan. Others specialize in contracting, physically building the structure, managing the site crew, and handling materials and supply. In other cases, civil engineers focus on maintenance of the project after it is completed, to make sure that it is safe and useful.

Most people pick a focus while they are receiving an education. Engineers who focus on transportation, for example, might choose to specialize in building bridges, tunnels, and roads. Others might lean towards power generation facilities, water treatment, waste management, construction of light railways and subways, or other disciplines. In all cases, extensive training is undertaken so that the prospective civil engineer understands his or her chosen field in depth. Behind every major public works is a team of civil engineers.

One of the primary concerns of civil engineering is public safety and health. A value is also placed on building structures that are functional, efficient, and also aesthetically pleasing. Structural soundness, conformity with local codes, and functionality are all issues which are faced in the discipline. Some civil engineers work directly for the public in the form of government agencies, while others find employment with public firms.

Education does not end with a degree and a course of fieldwork with trained and experienced civil engineers. Continuing education is also an important part of this discipline. As advances are made in the field, engineers are expected to keep pace with them, especially when the advances improve safety for workers and the public. There are many trade journals and annual conferences in the field to keep engineers updated.

Hydraulic engineering

Hydraulic engineering as a sub-discipline of civil engineering is concerned with the flow and conveyance of fluids, principally water and sewage. One feature of these systems is the extensive use of gravity as the motive force to cause the movement of the fluids. This area of civil engineering is intimately related to the design of bridges, dams, channels, canals, and levees, and to both sanitary and environmental engineering. Hydraulic engineering is the application of fluid mechanics principles to problems dealing with the collection, storage, control, transport, regulation, measurement, and use of water. Before beginning a hydraulic engineering project, one must figure out how much water is involved. The hydraulic engineer is concerned with the transport of sediment by the river, the interaction of the water with its alluvial boundary, and the occurrence of scour and deposition. "The hydraulic engineer actually develops conceptual designs for the various features which interact with water such as spillways and outlet works for dams, culverts for highways, canals and related structures for irrigation projects, and cooling-water facilities for thermal power plants."

What is Hydrology?

Hydrology is the scientific study of the movement, distribution, and quality of water on Earth and other planets, including the hydrologic cycle, water resources and environmental watershed sustainability. A practitioner of hydrology is a hydrologist, working within the fields of earth or environmental science, physical geography, geology or civil and environmental engineering.

Hydrology subdivides into surface water hydrology, groundwater hydrology (hydrogeology), and marine hydrology. Domains of hydrology include hydrometeorology, surface hydrology, hydrogeology, drainage-basin management and water quality, where water plays the central role.

Oceanography and meteorology are not included because water is only one of many important aspects within those fields.

Infiltration (hydrology)

Infiltration is the process by which water enters the soil. Some of the water is absorbed, and the rest percolates down to the water table. The infiltration capacity, the maximum rate at which the soil can absorb water, depends on several factors. The layer that is already saturated provides a resistance that is proportional to its thickness, while that plus the depth of water above the soil provides the driving force (hydraulic head). Dry soil can allow rapid infiltration by capillary action; this force diminishes as the soil becomes wet. Compaction reduces the porosity and the pore sizes. Surface cover increases capacity by retarding runoff, reducing compaction and other processes. Higher temperatures reduce viscosity, increasing infiltration.

What Does a Hydraulic Engineer Do?

A hydraulic engineer specializes in the effects of water in one or many disciplines. The nature of water in regard to flow, runoff, flooding, and how it is affected by weather can be used from an engineering perspective to help in the design of civil engineering projects. Hydraulic engineers help design dams and bridges, analyze the path of waste water in the ground, and study the effects of the ocean on the shoreline and offshore structures like oil platforms. They can also assist with human development or disaster planning in flood zones. Often assisted by powerful computer programs, hydraulic engineer duties sometimes involve working with other engineers and scientists as well as public officials.

The physical nature of the environment needs to be generally understood by a hydraulic engineer. Water flow and the forces that go along with it are often studied so that structures can be designed accordingly. Supports for bridges, and the capacity for a dam to support the weight of water in a reservoir, usually require the ingenuity of an engineer to be designed correctly. In agriculture, irrigation systems driven by gravity, pumps, or valves are typically designed according to engineering principles involving water.

Hydraulic engineer jobs can also be at industrial facilities. Industrial machines such as turbines, pipes, and pumps often operate on the flow of water. The design of car engines typically requires some analysis of the flow of gasoline. Engineers sometimes analyze the runoff of sewage in urban areas and the operation of hydraulic systems in water treatment plants. Knowledge of how to manage water resources is usually required to operate such systems, so a hydraulic engineer may work as part of the plant staff.

As part of the general workday, the hydraulic engineer job description often includes the need for computer skills. Software programs that specialize in data analysis and hydrologic modeling are used in many cases. Business meetings are sometimes a part of the routine, both with teams and external customers. Engineers specializing in hydraulics may need experience in aerodynamics if they are working for an aerospace company. They usually need to know how the hydraulic power components and actuators interact with other systems.

For many jobs, hydraulic engineer requirements include a degree in civil or agricultural engineering. Coursework in concepts related to a specialized field, such as oceanography, geophysics, or meteorology, may also be required. Skills in using computer aided design software or geographical information system programs are sometimes necessary as well.

此为试读,需要完整PDF请访问: www.ertongbook.com