

Cite this article

Heller V (2022)

Book review.

Proceedings of the Institution of Civil Engineers – Water Management **175**(2): 108, <https://doi.org/10.1680/jwama.21.00054>

Book Review

Paper 2100054

Received 09/06/2021;

Accepted 16/06/2021;

Published online 11/08/2021

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Book review

Hydraulic Engineering of Dams

W. H. Hager, A. J. Schleiss, R. M. Boes and M. Pfister. CRC Press, London, UK, 2021, ISBN: 978-0-415-62153-3, £130 (hardback)/£117 (eBook), 1080 pp.

This book is a significant extension of *Dam Hydraulics* by Daniel L. Vischer and Willi H. Hager with three experts replacing their retired teacher, tutor and colleague Professor Vischer, to whom this work is dedicated. Many new topics and extensive chapters on hydraulic engineering are included to reflect the new developments and findings from the last two decades.

This book contains 11 self-contained chapters. Chapter 1 introduces the purposes and importance of dams and gives an overview of the appurtenant hydraulic structures of dams, which are covered in the subsequent chapters. The first two main chapters are Chapter 2 'Frontal crest overflow' and Chapter 3 'Spatial crest overflow'. The former presents a classification of overflow structures followed by frontal overflow, which is essentially two-dimensional (2D) weir flow involving a large upstream still water depth, as well as additional weir effects and related scale effects relevant for laboratory investigations. Chapter 3 deals with spatial (three-dimensional (3D)) crest flow, including side channels, morning glory overfalls, labyrinth weirs, piano key weirs and siphons.

Chapter 4 entitled 'Spillway chute' includes information on smooth chutes, uniform aerated chute flow, chute aerators, shock waves, roll waves and stepped chutes. Cavitation on spillways can be prevented with sufficient flow aeration, such that the principal emphasis of this chapter is on air distribution, aerator devices, air transport and the provision of related design criteria. 'Dissipation structures' are covered in Chapter 5, including hydraulic jumps, stilling basins, drop structures and free-fall outlets. Chapter 6 'Ski jump and plunge pool' starts with ski jumps, perhaps the most spectacular type of energy dissipator in dam hydraulics, followed by flip buckets that ensure the desired jet trajectory, as well as granular and rock scours to avoid related hazards.

Chapter 7 'River diversion structures' is mainly relevant during the construction phase of dams. Diversion tunnels, river diversions and culverts, as well as pier and abutment scours are addressed. The first part of Chapter 8 'Intakes and outlets' focuses on high submergence intakes followed by low submergence intakes, some practical aspects such as floating debris and trash-rack vibrations and emergency gate closure, as well as gate flow. The second part of this chapter includes an extensive subchapter on low-level outlets and related aspects, such as gate vibrations and design criteria for air entrainment to prevent cavitation.

The last three chapters address unwanted side effects of dams related to hydraulic engineering, namely, 'Reservoir sedimentation' (Chapter 9), 'Impulse waves in reservoirs' (Chapter 10) and 'Dam breach' (Chapter 11). After short sections on sedimentation rates and distributions, as well as management concepts in Chapter 9, extensive sections concerning measures against reservoir sedimentation, sediment bypass tunnels, turbidity currents, sedimentation controls and some secondary hydraulic effects are reviewed. Impulse waves are covered in Chapter 10 with information on fundamental approaches, 2D impulse wave generation

and propagation, impulse wave types, as well as the transformation of solitary waves to overland flow. Also reviewed are slide underwater deposition features, as well as overtopping of rigid and erodible dams and finally spatial (3D) impulse waves. Chapter 11 addresses empirical breach data, progressive 2D breaches and fuse plugs; this chapter and the book close with instantaneous 2D breaches, also called dam break flows.

These 11 chapters are all self-contained, with their own notation and extensive bibliographies for further reading next to the cited publications. Each chapter starts with beautiful and impressive photographs in colour and all illustrations in the book are well presented and uniformly formatted. The volume also includes extensive subject and author indices, so it is convenient to be used as a reference book, both to refresh old knowledge and to obtain new information. Considering all this and an extent of 1080 pages, the price of £130 (hardback edition) is reasonable.

This well-written and comprehensive book is one of the few currently available on the market on dam hydraulics and engineering. It meets the needs of both academics and practising hydraulic engineers, with many useful case studies, design guidance and summaries of research findings. It is therefore recommended to postgraduate students, practitioners involved in the design of the appurtenant structures of dams and researchers and academics who are active in hydraulic engineering.

The focus is on physical hydraulic modelling, sometimes supplemented by prototype observations and analytic results. As is the case for all books, some aspects could not be included. Physical modelling is the main expertise of all four authors, such that numerical contributions are widely excluded. Also excluded are pressure tunnel designs, despite published work by the authors in this field, and some classical aspects such as pipe flow losses and pressure surges, which can, however, readily be found in classic textbooks.

This book further demonstrates the authors' significant achievements in physical hydraulic modelling at the two Swiss Federal Institutes of Technology (ETH Zurich, EPFL). They combine a total period of experience of over a century in the fields of hydraulics and hydraulic engineering. The book benefits from the experience of the authors' work both in academia and industry and over 30 published and edited books, with approximately 2000 additional publications overall. The authors' own contributions to all chapters are therefore significant, and they are well put into the context of basic knowledge. This makes the book a welcome contribution for studying entire chapters about the hydraulic engineering of dams, as a reference book for design purposes, as well as an inspiration for future research studies.

In summary, this is the most comprehensive and up-to-date book on the hydraulic engineering of dams currently on the market. It is highly recommended to postgraduate students, researchers, academics and practising hydraulic engineers working on the design of the appurtenant structures of dams, as well as in related fields such as open channel flows and hydraulic structures. This book promises to be an inspiration for many current and future researchers and practitioners in hydraulics and hydraulic engineering.

Valentin Heller