Review

JÓHANNESSON, T., P. GAUER, P. ISSLER and K. LIED, *eds*. 2009. *The design of avalanche protection dams: recent practical and theoretical developments*. Brussels, European Communities. 195pp. ISBN 978-92-79-08885-8, softback, free.

The book *The design of avalanche protection dams* recently published by the European Union's (EU) Publications Office summarizes recent research carried out within the EU-funded project SATSIE (Avalanche Studies and Model Validation in Europe), which focused on avalanche dynamics, with heavy emphasis on mitigation techniques and hazard zoning. The enterprise is interesting insofar as the snow-avalanche community is small and sharing points of view, data and experiences is valuable. The book is available free of charge, from the EU bookshop (http://bookshop.europa.eu), which is laudable. Moreover, unlike the typical project report, it is more than a compilation of results obtained by the various partners. Great care has been devoted to figures and layout, which makes it a pleasure to read.

The catastrophic winter of 1999 (60 inhabitants killed in the Alps) gave new impetus to snow-avalanche research. Three main questions were raised: how to compute extreme avalanches? how to make avalanche maps and hazard zoning more reliable? and how to design a protection system to cope with extreme events? The book gives some insight into the first two points, but its central topic is dam design. Various aspects are dealt with in the 16 chapters.

The first four chapters introduce the reader to the matter of the book, giving an overview of the problems encountered in engineering, and presenting basic notions of avalanche dynamics. Chapters 5–8 address the design of deflecting and catching dams. For a long time, the interaction between an avalanche and a large-size obstacle has been addressed using point-mass or sliding-block models. Emphasis is now given to hydraulic models, which make it possible to compute and estimate a number of parameters that are crucial when designing dams: shock wave (bore) and impact wave, energy dissipation, run-up elevation, etc. No mathematical derivation of the equations is provided. This may be personal preference, but I think that such derivation is essential to fully understanding the results and their limits. The results are, however, clearly described and will interest both the non-specialist and the engineer. Some of the results (run-up, deposition pattern) are compared with field data, which gives the reader a better idea of the agreement between field measurements (on real avalanches) and model outcomes. Chapter 9 is devoted to braking mounds. Much of the material stems from Hákonardóttir's (2004) thesis; her laboratory and outdoor experiments on granular flows and snow flows provide a solid basis for testing hydraulic models, in particular the interaction of a high-speed avalanche with an obstacle. In that case, the dominant balance in the governing equations involves inertia and pressure-gradient terms, while details of the rheological behavior are of less importance, hence the suitability of the approach for real snow avalanches. Chapter 10 addresses the delicate problem of the interaction of a powder-snow avalanche and a dam. Numerical simulations and experimental results (from scaled-down experiments in the laboratory) are summarized and recommendations are drawn for practical applications. Chapters 11–13 focus on avalanche impact against masts and walls. The main idea is to generalize the drag coefficient used in hydrodynamics to compute the effect of fluid on a static/moving object. Chapter 14 is not directly related to snow avalanches since it treats snow creeping, but sometimes a snow cover sliding down a slope may produce effects similar to those produced by a wet-snow avalanche. Chapter 15 outlines some geotechnical issues encountered in building up dams. The objective is clearly to widen engineers' horizons in terms of construction. Chapter 16 lists unresolved questions that deserve further attention. A series of technical appendices are particularly useful for practical applications or extending discussions initiated in the preceding chapters.

The book has some shortcomings, which preclude it from being a comprehensive report delivering the state of the art in terms of avalanche protection and avalanche dynamics. It summarizes recent research, but strangely enough fails to engage to any great extent with the work of others; most recent publications (papers and books) about avalanche dynamics are omitted (e.g. Bartelt and others, 2005, 2006, 2007; McElwaine and Turnbull, 2005; Pudasaini and Hutter, 2006; Turnbull and others, 2007; Turnbull and McElwaine, 2008). The target reader is not really identified if the book aims to be more than a review. For scientists, the material is somewhat oversimplified. As mentioned, there is no derivation of the governing equations, and, even more frustratingly, there is no proper reference to handbooks or papers where one can find the missing material. In many places throughout the text, assumptions and results are cursorily alluded to. It would have been helpful to know what is currently considered sound knowledge and what is considered speculative interpretation. For engineers, there are a few crisp and self-contained chapters that provide important and positive lessons that the reader can take away and use fruitfully, but many chapters are essentially descriptive and do not provide any know-how or step-by-step procedures. Some important questions are not addressed, such as the computational tools needed or the statistical approach (even though this was part of the SATSIE project). Another defect, typical of multiple-author books, is that despite careful editing, there are inconsistencies of style which jump out at the reader. For instance, appendix G, which is devoted to national regulations concerning land-use planning and hazard zoning, provides a detailed analysis of the Swiss and Austrian systems, but only a historical perspective for France and the reader misses the opportunity to compare the different policies.

On the whole, the book is a valuable addition to my library. It could serve as a review summarizing recent research activities inside the EU. Trained engineers and practitioners will find useful information on recent developments concerning avalanche-catching dams. This practice-oriented book can also usefully supplement and illustrate more comprehensive books on hydraulic models and avalanche dynamics (e.g. Pudasaini and Hutter, 2006).

https://doi.org/10.3189/002214309789470888 Published online by Cambridge University Press

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https://doi.org/10.3189/002214309789470888 Published online by Cambridge University Press