Preface

Pelton turbines have been used for over 100 years to convert hydraulic energy into mechanical work, as well as to generate electricity. The experiences achieved during this long period have enabled Pelton turbines nowadays to be designed and built with high hydraulic and mechanical performances. Nevertheless, there had been until the end of the last century a noticeable lack of fundamental explanations to the hydromechanics of this type of turbines.

To extend the general knowledge of Pelton turbines, the author started his experimental research on jet flows in Pelton turbines at the beginning of the twenty-first century within an R&D project of the company Andritz Hydro (former VA TECH Hydro) in Switzerland. Extended studies with the entire hydromechanics of Pelton turbines as a part of research and development activities were carried out at the Oberhasli Hydroelectric Power Company (KWO AG) from 2004 to 2007. The results achieved through these research works have already been published in both journals and conference proceedings and later summarized in German in the textbook "Freistrahlturbinen", Springer-Verlag, 2009. The current book originates from that German version and is extended with new knowledge, partly obtained at the Laboratory of Hydraulics, Hydrology and Glaciology (VAW) of ETH Zurich.

In this textbook, the foundations of hydromechanics of Pelton turbines are presented from an engineering viewpoint of hydraulic designs and optimizations. In terms of reference, the content thus concentrates on the detailed flow processes and their quantitative descriptions regarding all relevant hydro-mechanical aspects. This includes the computational methods for determining the interaction between the jet and the rotating buckets, quantifying diverse flow losses in the system and specifying flow phenomena like the frictional effect and load shedding, which leads to the acceleration of the Pelton wheel rotation towards its runaway speed. The book also reveals the possible potential for further enhancing the system efficiency by indicating the most significant sources causing the greatest efficiency drops. It, thus, provides a useful reference with design and operational criteria for practical applications.

For all these reasons, this textbook is suitable for development and design engineers of Pelton turbines, as well as for those working in the field of fluid machinery. The examples presented in this book generally apply to students in advanced "fluid mechanics". The author would especially welcome a lot of mechanical laws and rules presented in the textbook to be implemented in the context of Computational Fluid Dynamics (CFD). This should greatly contribute to the simplification of the CFD simulations without having always to start from the basic foundations, i.e. the Navier–Stokes equations.

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