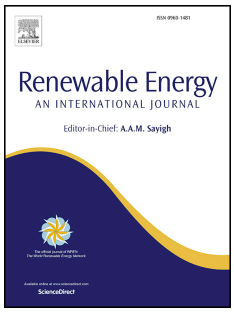
Accepted Manuscript



Overshoots in the water-level control of hydropower plants

Riccardo Vesipa, Luca Ridolfi

PII: S0960-1481(18)30887-5

DOI: 10.1016/j.renene.2018.07.090

Reference: RENE 10364

To appear in: *Renewable Energy*

Received Date: 24 April 2018

Revised Date: 16 July 2018

Accepted Date: 18 July 2018

Please cite this article as: Vesipa R, Ridolfi L, Overshoots in the water-level control of hydropower plants, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.07.090.

Overshoots in the water-level control of hydropower plants

Riccardo Vesipa[a,*], Luca Ridolfi[a]

[a]*Department of Environment, Land and Infrastructure Engineering, Politecnico di Torino, C.so Duca degli Abruzzi 24, 10129 Torino, Italy*

Abstract

In the field of renewable-energies, a number of engineering problems are modeled as dynamical systems, and a key issue is the assessment of their stability to external disturbances. Stability analyses typically focus on the asymptotic stability, i.e., the fate of perturbations after long times from their onset. The system behavior at finite-times has attracted much less attention, although it plays a crucial role in determining the system dynamics. In this work, we focus on the response at finite-times to perturbations in run-of-river hydropower plants. These are widespread systems in the hydropower industry. We show that their response at finite-times (i) can be analytically studied by the non-modal analysis, and (ii) can be very different from the asymptotic-times response. In particular, perturbations can exhibit very relevant transient amplifications (with important technical consequences), although the system is asymptotically stable. The proposed analytical approach is general and can be applied to investigate the finite-time response of any dynamical system.

Keywords: run-of-river hydropower plant, finite-time stability, stability analysis, non-modal analysis

2010 MSC: 00-01, 99-00