The Hydro Turbine Governor
and Why it is Important to Understand it
by
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An overview of the hydro turbine governor will be given. The idea of the governor was first treated
analytically by Clark Maxwell in the 19th century. Governor action was correctly seen as something
very important in the days when hydro plants were installed as the sole or the principal contributor to a
small power system. As large interconnected systems developed, the large number of loads and
generators obscured the action of the governor. Less interest was taken in how the governor should be
specified and adjusted for use in a large interconnected system. However, mysterious power flows
began to be seen in generation areas where the generation was predominantly hydro. This led to
governor setting policies, which are valid today. Now, we have the ability to build very large computer
models and to demonstrate the significance of the governor. In addition, it has been demonstrated that
the computer models may indicate that a system is robust, while real life experience shows that the
system has collapsed. This anomaly has been explained by inadequate representation of the hydro
turbine and its governor. It is now a requirement of the System Operator that hydro power plant
owners submit data that will allow realistic models to be developed for inclusion in system models.
This tutorial is intended to prepare engineers, as well as practitioners of other profiles and students
interested in the hydro power generation, to understand the operation of governor and to describe the
control system and the hydro turbine governor control parameters.

John Codrington received his B.Sc. (Hons) in Mechanical Engineering from University of Manchester,
England in 1964. He has been with Acres, and now Hatch Energy, for 43 years and has contributed to
many different projects. His most recent experience has been in hydroelectric engineering, much of
this being in Latin America and Iran. He made a major contribution to the conceptual work and was
responsible for the specifications for the Pelton turbines and the gates for the San Gaban hydroelectric
project, Peru. He contributed to a proposed high head Pelton station in Guatemala, making
recommendations to deal with hydraulic transients. He was more recently assigned overseas to work
on the 2000 MW Karun III project in Iran, where he was responsible for the design review of all
mechanical equipment including the Francis turbines, the governors, the gates in the high head arch
dam, and other equipment in the powerhouse. He participated in the shop testing of the governor,
where a feedforward algorithm requested in the specifications was coded in and successfully tested in
the course of the shop testing. He has participated in studies dealing with dynamic problems and
frequency regulation at a hydroelectric plant supplying a mining and smelting operation in Indonesia.
He has a strong background in analysis of transients in pumping installations and hydro plants.

He prepared a computer model to investigate the dynamic behaviour of the interconnected electrical
system following a proposed intertie between Kenya and Tanzania. This model was focussed on prime
mover control and investigated how the system and the proposed tie lines responded to load changes.

Mr. Codrington prepared technical specifications and participated in procurement of hydro turbine
governor systems for major projects such as Churchill Falls, Labrador, Akosombo in Ghana, and Karun
III in Iran. In each of these cases, special demands were made on the governor systems and special
features were specified.

He recently participated in studies for the Blue Lake project for the City of Sitka, where a preliminary
surge tank configuration was developed and estimates were made of the local power system frequency
response to load demand changes. A customized computer model was prepared to analyze the response of the electrical system to demand changes.

Mr. Codrington is a registered Professional Engineer in the province of Ontario, and a Life Member of the American Society of Mechanical Engineers (ASME).

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