

### 3.11 SCALE EFFECT CONCERNING HYDRAULIC QUASI-STATIONARY OSCILLATIONS ON A TURBINE MODEL AND TEST CIRCUIT

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#### DISCUSSION

Prof. S Pejovic (University of Belgrade, Yugoslavia)

You have made a very detailed investigation of the model test-beds and obtained a lot of very interesting and valuable results. How can you use these results in designing the power plants?

Dr H Brekke (Kvaerner Brug AS, Norway)

Concerning the disagreement between calculation and measurement for steady-state flow in the turbine I believe that a damping function of the oscillatory flow from the tube connected to the piston machine and the draft tube should be included. (See Fig. 5 and equation (16) in my Paper 3.2, page 220.)

My question is - Have you included a damping term in the T-joint connecting the piston machine and the draft tube which will take into consideration the flow velocity in the draft tube.

#### AUTHOR'S RESPONSE

Prof. P Henry to Prof. S Pejovic

Our model tests and theoretical studies are conducted with two main aims.

1 Knowledge and understanding of excitation frequencies and amplitudes, as well as influencing parameters. Using this knowledge, it therefore becomes possible to improve the design of the draft tube and the design of the runner components: crown, band and blades. Generally speaking, the design of runner will not influence the power plant arrangement, but the design of draft tube will do, especially with respect to draft tube depth and draft tube liner design.

2 Knowledge of 'passive' components responses, due to their resistance, inertia and capacitance effects. If this knowledge is well established, it becomes possible:

- to understand the so-called 'scale effects' occurring during model tests
- to define test conditions in such a way that excitation results are not strongly disturbed by circuit peak responses
- to transpose scientifically model results to prototype scale, taking into account the response of passive components of prototype.

Of course all the objectives have not been achieved, but in the near future, it is not really unreasonable to prognose power plant modifications as a consequence of model tests and modelization results.

Prof. P Henry to Dr H Brekke

In principle we agree with your suggestion to include a damping term relative to the loss of the flow passing from the piston outlet section to the draft tube bend.

At the time the paper was prepared, that inclusion was not realised.