Abstract Submitted
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Sloshing motion dynamics of a free surface in the draft tube cone of a Francis turbine operating in synchronous condenser mode ELENA VAGNONI, LOïC ANDOLFATTO, ARTHUR FAVREL, FRANÇOIS AVELLAN, École polytechnique fédérale de Lausanne — The penetration of the electrical grid by intermittent renewable energy sources induces grid fluctuations which must be compensated in order to guarantee the stability of the grid. Hydropower plants can supply reactive power to ensure the grid stabilization by operating in condenser mode. In this operating mode, the turbine operates with the tail water depressed to let the runner spin in air to reduce the power consumption. Pressurized air is injected in the draft tube cone to maintain the water level below the runner and this induces air-water interaction phenomena which cause important power losses. Flow visualization and pressure fluctuation measurements are performed in a reduced scale physical model of a Francis turbine operating in condenser mode to investigate the dynamics of the air-water interaction in the draft tube cone which causes the sloshing motion of the free surface. An image post-processing method is developed, enabling a quantitative description of the sloshing motion. The latter depends on the Froude number. By increasing the value of the Froude number, the amplitude of the sloshing motion decreases, as well as the amplitude of the pressure fluctuations. The frequency of the sloshing motion corresponds to the first natural frequency of the water volume.

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