

## عنوان مقاله:

Flow Field Analysis of Francis Turbine Draft Tube using POD at Design and Part Load Operating Conditions

## محل انتشار:

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## خلاصه مقاله:

The hydraulic turbines, especially Francis turbines, frequently run at part load (PL) conditions to meet the dynamic energy needs. The flow field at the runner exit changes significantly with a change in the operating point. At PL, flow instabilities such as the Rotating Vortex Rope (RVR) form in the draft tube of the Francis turbine. The present paper compares the features of the velocity and vorticity field of the Francis turbine draft tube at the best efficiency point (BEP) and PL operations using the Proper Orthogonal Decomposition (POD) of the ۲D-PIV data. The POD analysis decomposes the flow field into coherent and incoherent structures describing the spatiotemporal behavior of the flow field. A visual representation of the coherent structures and the turbulent length scales in the flow field is extracted and analyzed for BEP and PL, respectively. The study highlights the salient features of the draft tube flow field, which differentiate the BEP and PL operation. The fast Fourier transform of the temporal coefficients confirms the presence of RVR frequency (۰.۲۹ times the runner frequency) at PL. The phase portraits of different modes elucidate the relationship between different harmonics of the RVR frequency at PL.

## کلمات کلیدی:

POD, Part load, Vortex rope, Dissipation, Francis turbine

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