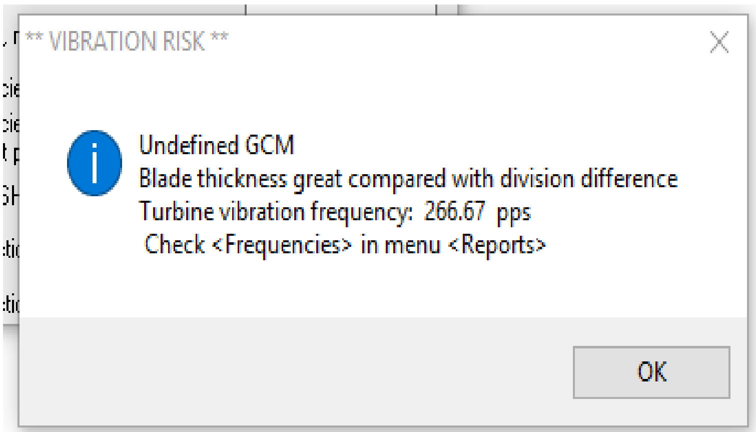
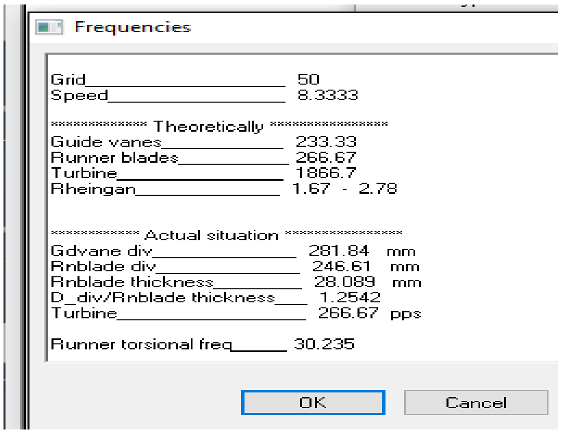
Alab Dispatches

Speed related frequencies





In a recent project Alab was used to analyze vibration problems related to low specific speed Francis turbines.

The theoretical approach

The theoretical approach considers guide vane outlet end to be a point, and the wake to be a curve with no thickness. Runner blade inlet is also defined as a point.

GCM is the number of vanes/blades in the same position at the same time.

The turbine will be exposed to a frequency depending on GCM. If GCM is 1.0 this will be a very high frequency, but probably with low energy. GCM equal to ZGV or ZR will reduce frequency, but the energy involved will be higher.

In the real world

In the real world guide vane trailing edge and resulting wake is far from a point or line. Both guide vane and runner blade have dimensions according to mechanical specifications.

The power in the guide vane wake is visualized by eroded areas on the draft tube cone, after runner outlet!! In front of the runner blade a wave front is created due to a hydraulic necessity.

During operation guide vane and runner blade have to be represented by sectors and calculation of GCM is out of question. To be able to estimate/calculate a safe combination of number of guide vanes and runner blades access to data related to units in operation is necessary.

Based on both theory and real world experience, Alab is continuously expanded with new methods and calculations. A method for calculating speed related frequencies is now present.

The complete documentation is found on our hydropower community site, Alab Acuity. Search for page “Speed related frequencies”, or use https://alabdocs.atlassian.net/wiki/display/WD/Speed+related+frequencies