Aim & Objectives

The aim of the project is to characterize the erosive wear in the needle of a Pelton turbine by solving a particle-laden flow model through iLES/uDNS Spectral Methods.

Objectives

- To develop a model to predict the flow near to the needle using Spectral methods with an appropriate parameter selection.
- To study different models of particle-laden flows and select the most appropriate one to study under different conditions.
- To study LES methods and particularly iLES spectral methods to solve Navier-Stokes equations.
- To determine the parameter values of SVV to specific conditions under simulation.
- To implement the model of flow near to the needle using Nektar++ and the appropriate SVV parameters.

Methodology

To develop a model to predict the flow...

1. To study the different models of particle-laden flows and select the appropriate one to the flow under study.
2. To study LES methods and particularly iLES spectral methods to solve Navier-Stokes equations.
3. To determine the parameter values of SVV to specific conditions under simulation.
4. To implement the model of flow near to the needle using Nektar++ and the appropriate SVV parameters.

To evaluate the transport of particles in...

1. To study a transport model of particles with an established velocity field.
   \[
   \frac{d\mathbf{r}}{dt} = \mathbf{F} (\mathbf{u}, \rho, \mathbf{u}, \mathbf{v}, \mathbf{w}, \ldots)
   \]
2. To implement the model using the Nektar++ library.
3. To evaluate the particle-laden model suitable by comparison of case of study available on the literature.

To assess the erosive wear rate...

1. To study the different models to evaluate the erosive wear rate and to select the proper one for the conditions of flow and materials.
   \[
   \frac{dW}{dt} = \int_{S} F (|\mathbf{u}|, \alpha, \beta, \gamma, \delta, \ldots) dS
   \]
2. To implement the model using the Nektar++ library.