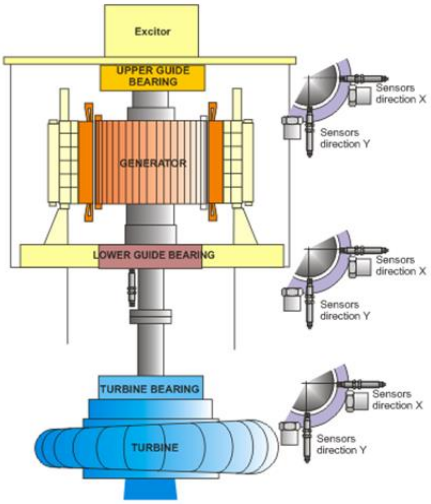
CoDiS (Computerized Diagnostic System) machine condition monitoring is equipped with **add on expert module, CoDiS CSBS (Critical speed and Bearing Stiffness)**, which is used to determine the dynamic properties of the machine in exploatation. This is important as very often the real system response is not consistent with design data obtained by OEMs resulting in problems during commissioning and exploatation that can't be verified and easily identified by the end users.



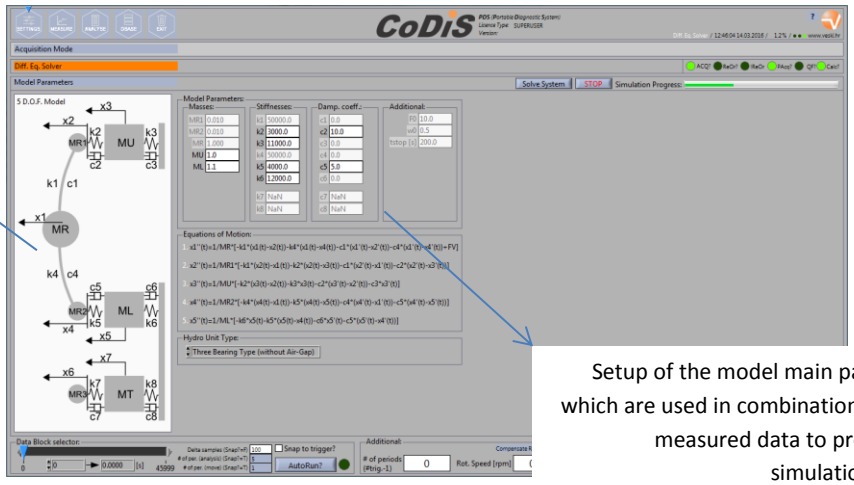
MATHEMATICAL MODEL OF THE HYDRO GENERATOR

CoDiS system enables the mathematical modelling of the hydro generator. Inputs are obtained from the real measurements of relative and absolute vibrations. These measurements typically exist whenever portable or permanent vibration monitoring system is installed. They are used in such a way as to enable calculation of the parameters (masses, stiffnesses, damping coefficients and critical speeds) which give the same vibration response as that which is measured.
From the calculated values, the vibration response can be extrapolated to higher rotational speed thus enabling prediction of vibration response in overspeed. Also, by changing adequate parameters, different vibration responses can be obtained thus enabling detection of different fault conditions.
The benefits of the module are:

- identification of dynamic behaviour of the unit (vibration response)
- estimation of critical speed and bearing stiffnesses
- prediction of faults by system vibration response observation by varying different parameters

Mathematical model of the hydro generator

Definition of model type Based on the generator design



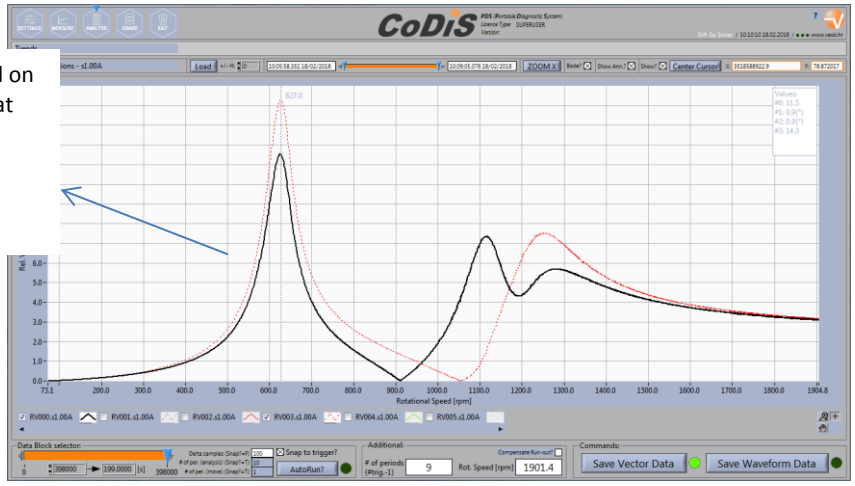
Setup of the model main parameters which are used in combination with real measured data to produce the simulation output.

Simulation results

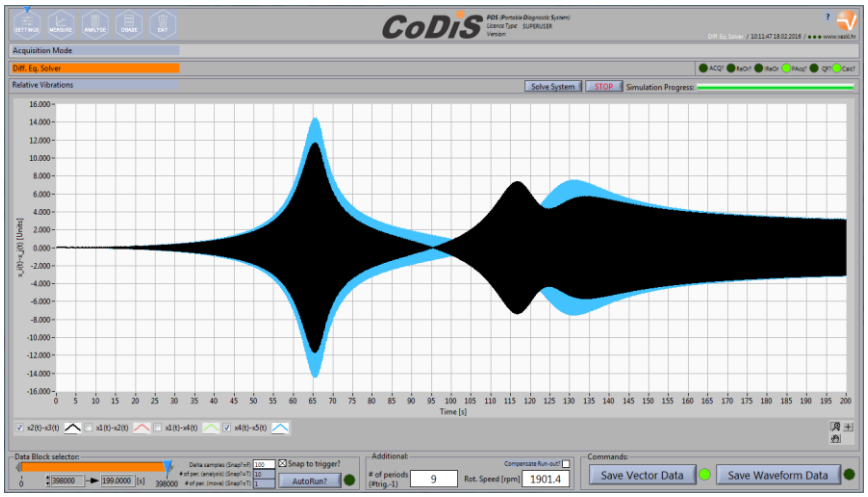
CoDiS CSBS (Critical speed and Bearing Stiffness) module provides the following data based on real measurements and mathematical model of hydro generator:

- **Bearing stiffnesses**
- Critical speeds (up to 3rd)
- Fundament stiffnesses

Simulation response based on the real measurements that are used as input data for mathematical model.



Simulation results - Critical speed vs RPM



Simulation results in time domain