We investigate numerical modeling and analysis of wind turbines with high-pressure hydraulic transmission machinery. A dynamic model of the hydraulic system is developed and coupled with the aeroelastic code HAWC2 through external Dynamic Link Library. The hydraulic transmission system consists of a hydraulic pump, transportation pipelines, a hydraulic motor, and check valves. By use of the Runge-Kutta-Fehlberg method with step size and error control, we solved the Ordinary Differential Equations of the hydraulic system with a time step smaller than the one used in the HAWC2 main program. Under constant and turbulent wind conditions, the performances of a land-based turbine during normal operation are presented.

### Objectives

During the study, the research objectives are the following:
- To model the hydraulic transmission system by Ordinary Differential Equations
- To propose an approach for numerical simulation of hydraulic turbines

### Results

#### Constant wind, Turbulence Intensity=0

- **Hydraulic pump pressure (bar)**
  - Constant wind, Turbulence Intensity=0
  - Generator power
  - Aerodynamic power

#### Uhub=8 m/s, Turbulent wind, Turbulence Intensity=0.23

- **Hydraulic pump pressure (bar)**
  - Generator power
  - Aerodynamic power
  - Rotor speed
  - Hub-height wind speed

### Conclusions

- The presented numerical approach is robust and efficient
- The hydraulic wind turbine has decent performance under constant and turbulent wind conditions

### Acknowledgment

The authors gratefully acknowledge the financial support from the European Commission through the 7th Framework Programme (MARINA Platform—Marine Renewable Integrated Application Platform, Grant Agreement 241402).

### References


Refer to the paper for more.