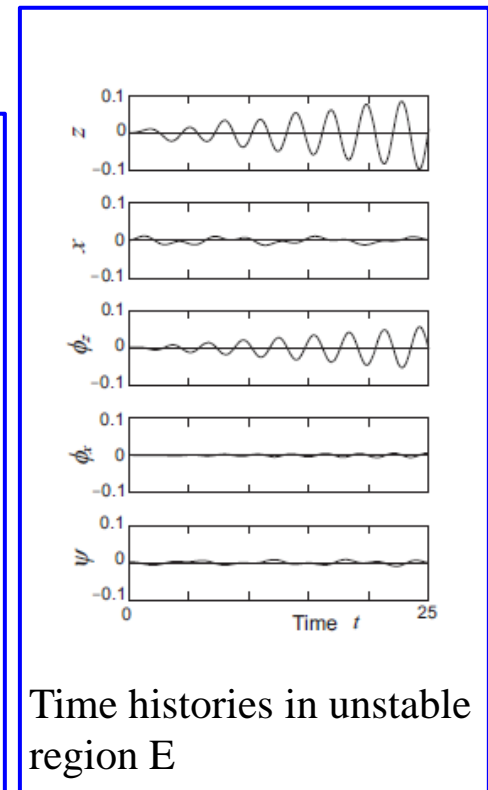
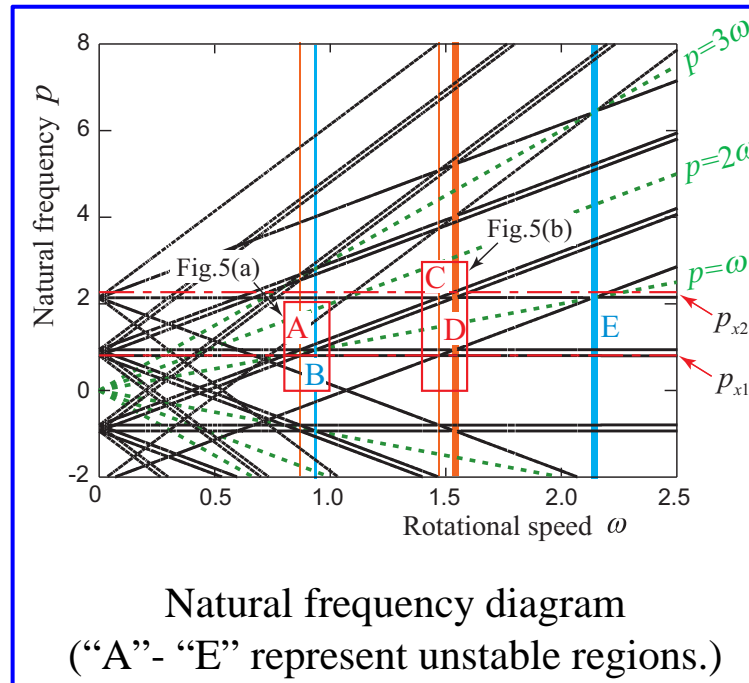
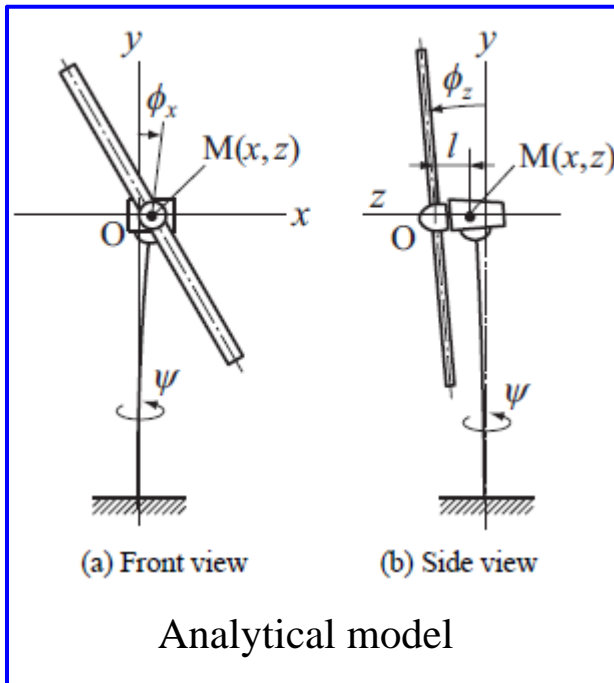


# Vibration Analysis of Wind Turbines



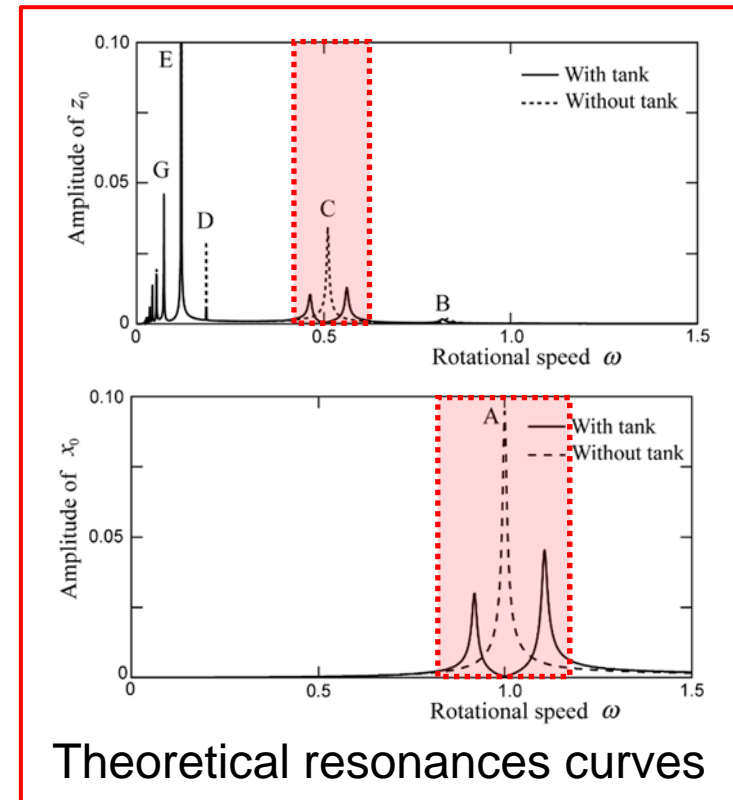
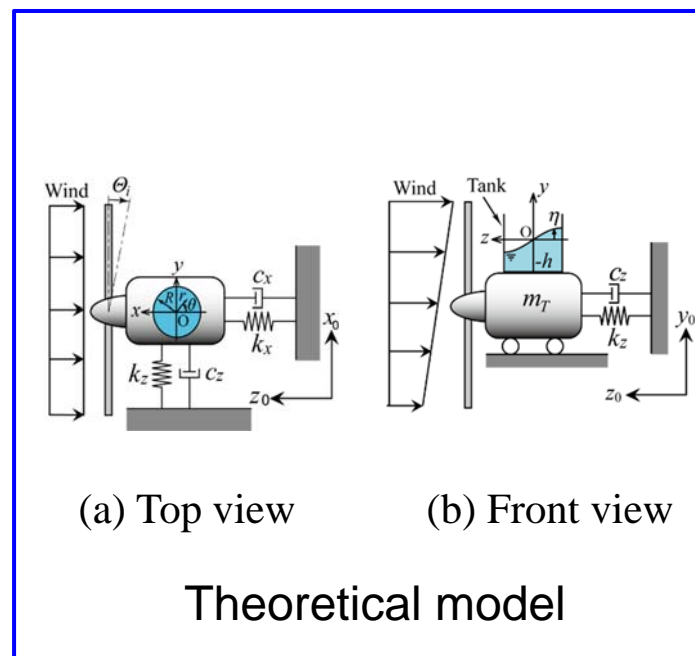
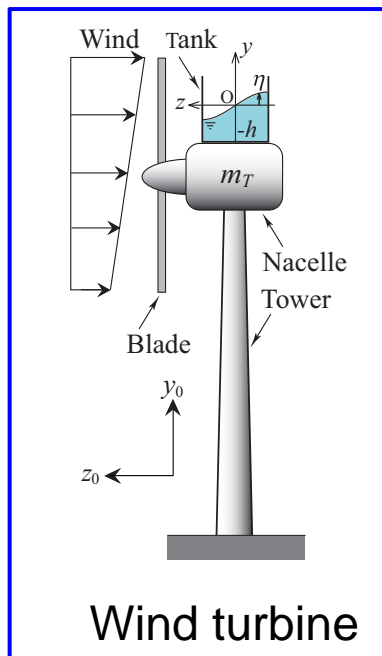
- Investigation of vibrations of a wind turbine tower
- Vibration control by using a turned liquid damper

Example of collapse of wind turbine



# Vibration Control of Wind Turbines Using Tuned Liquid Dampers

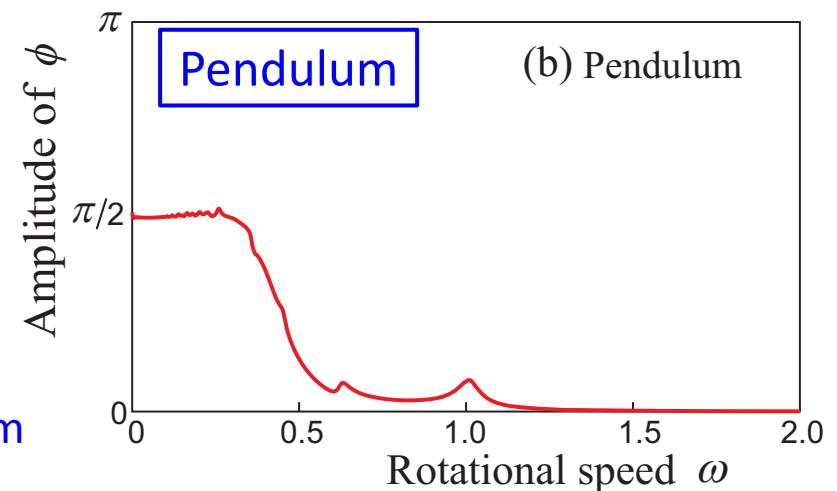
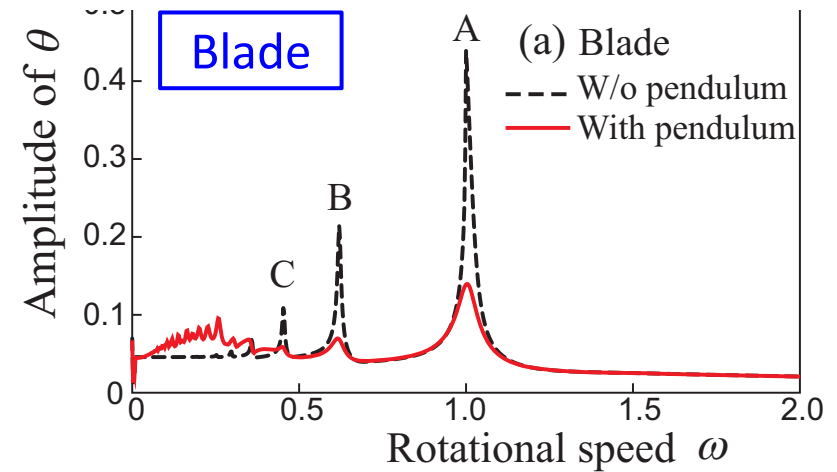
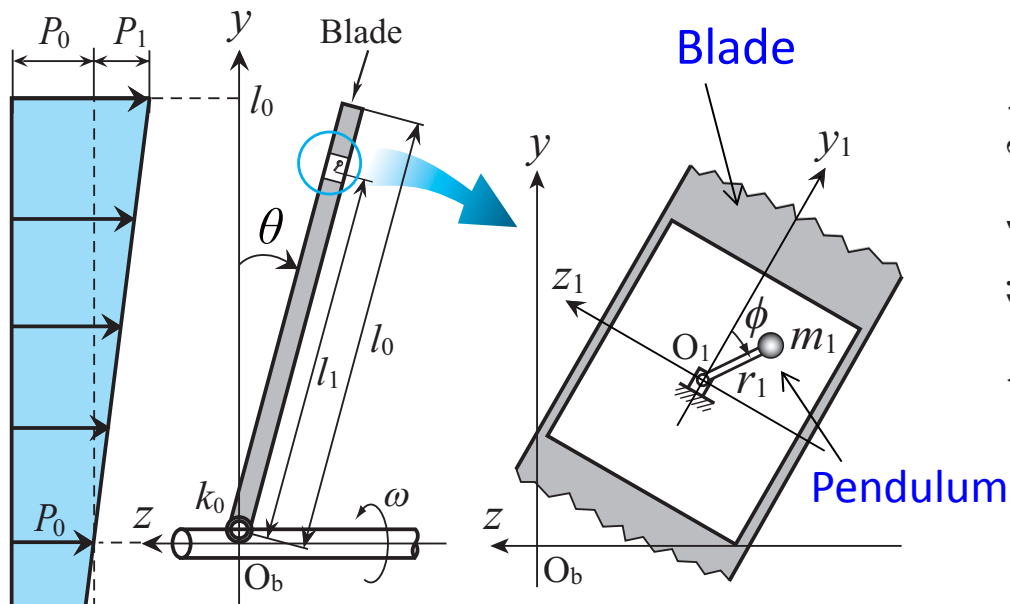
- Consider the wind turbine which has four DOFs, consisting of the tower translations,  $x_0$  and  $y_0$ , and the inclination angles of the two blades,  $\Theta_1$  and  $\Theta_2$ .
- A cylindrical-type tuned liquid damper (TLD) is installed on a nacelle to suppress the vibration of the tower.



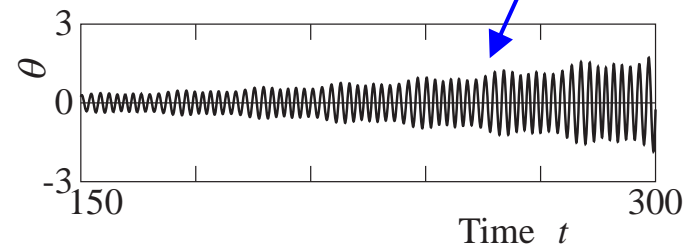
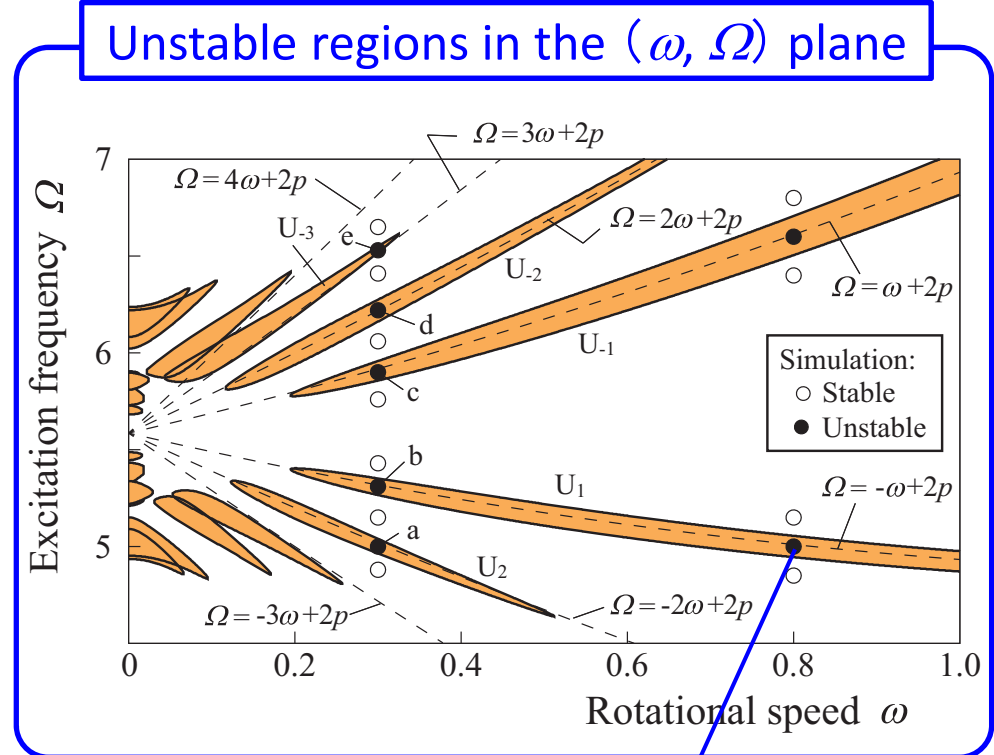
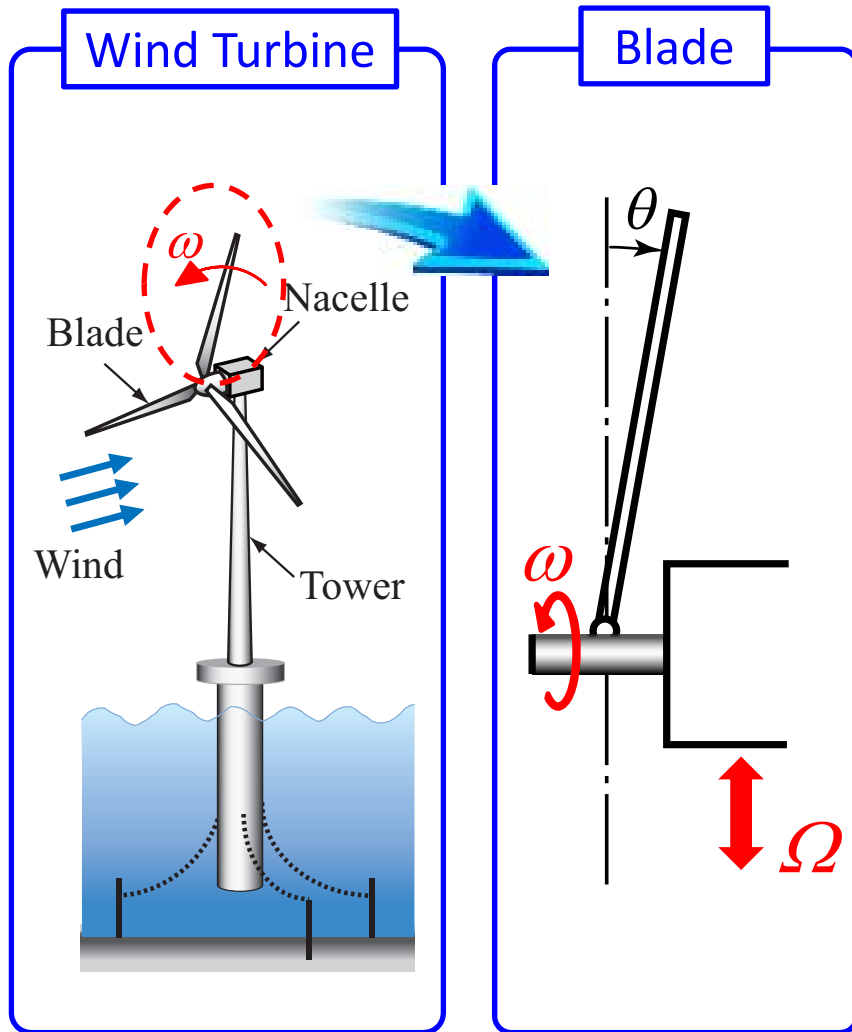
A cylindrical-type TLD works efficiently to suppress the vibrations of the tower at peaks A and C simultaneously.

# Vibration Suppression of Wind Turbine Blades Using Pendulum-Type Vibration Absorbers (PVA)

- A pendulum-type vibration absorber (PVA) is installed in turbine blades to suppress the vibration of the blades.
- Several peaks of the blade can be simultaneously suppressed at low amplitudes.



# Unstable Vibrations of Blades in Floating Wind Turbines



Unstable vibrations