Operating turbine

Measurements $y$
- Generator torque $Q_g$
- Rotor speed $\Omega$
- Pitch $\theta_p$
- Tower-top acceleration

Wind speed and thrust estimation
Tabulated data:
- $C_P(\lambda, \theta_p)$
- $C_T(\lambda, \theta_p)$

Kalman filter
- Previous states $x_{k-1}$
- Current inputs $u = [T_a, Q_g, \theta_p]$
- Current measurements $y$
- Noise levels $Q, R$
- Estimated states $x_k$
- Structural DOF $q, \dot{q}$
- Aerodynamic torque $Q_a$

Turbine model

Estimated states $x_k$
- Tower loads and fatigue

Wind speed and thrust estimation
Tabulated data:
- $C_P(\lambda, \theta_p)$
- $C_T(\lambda, \theta_p)$

Kalman filter
- Previous states $x_{k-1}$
- Current inputs $u = [T_a, Q_g, \theta_p]$
- Current measurements $y$
- Noise levels $Q, R$
- Estimated states $x_k$
- Structural DOF $q, \dot{q}$
- Aerodynamic torque $Q_a$