

ELEC-E8422 An Introduction to Electric Energy

#### Homework 4: Wind Energy

Tip speed ratio is a concept used in association with wind turbines.

- a) Explain how it is defined why it is important
- b) How the operation of wind turbine is optimized when tip speed ratio changes

#### Solution of Homework 4

- a) Tip speed ratio is defined as the ratio of the speed of the tip of a wind turbine's blade to the speed of the wind as

$$TSR = \frac{V_{tip}}{V_{wind}}$$

where  $V_{tip}$  is the speed of the tip of a wind turbine's blade, which is the product of angular speed and the radius of the blade's length, and  $V_{wind}$  is the speed of the wind.

TSR is an important concept since it adjust the output power of the turbine.

- b) In order to have the maximum efficiency from the turbine, TSR should be adjusted. This can be done by adjusting the pitch angle of the blades or changing the speed of the generator.