The purpose of wind turbines and their predecessors the windmill, is to convert the energy in the wind to usable energy forms. Whereas windmills of the past focused on the conversion of wind power to torque for grinding, pumping and winching, modern wind turbines convert the wind energy into electric power. They do so through incorporation of generators, which convert mechanical torque into electricity. Wind turbines are designed to keep the overall cost per produced Kilo Watt hour as low as possible. One way of improving the performance and lifetime of the wind turbine is through active flow control. Active control is often considered costly but if the lifespan of the components can be increased it could be justifiable. This thesis covers various aspects of ‘smart control’ such as control theory, sensoring, optimization, experiments and numerical modeling.