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A RESEARCH PROJECT FOR THE MULTIDISCIPLINARY DESIGN, OPTIMIZATION AND MANUFACTURING

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Abstract.*The production of electricity from renewable sources has grown significantly in recent decades. In this growth, wind energy has played, and continues to play, a very important role. This increase in production has been accompanied by a rapid increase in the size of wind turbines. This is mainly because larger turbines allow for greater energy production and thus a faster recovery of the investment. However, the increase in size, in order to be economically competitive, has required several technological developments to reduce the Cost of Energy (COE). In addition, much attention has been paid to the development of tools that allow simulating and designing modern wind turbines in a relatively short time and with great accuracy. In this field was the research activity presented in this work, in which a multidisciplinary approach for the design of wind turbines has been developed. The various engineering fields that characterize a wind turbine are combined together in an optimization framework where aerodynamics, structure and control are simulated, with state-of-the-art engineering models, simultaneously during the design loops. In this fashion, it is possible to marry the need to reduce computational costs coherently with the industrial schedules and the need to have from the beginning the whole process modeled with sophisticated tools. Moreover, this approach, allows including in this design framework modern technologies, such as passive load alleviation systems or modern wind farm control, which can easily be incorporated into the design and manufacturing process.*