DEVELOPMENT OF MOBILE MACHINING CELL FOR THE WIND TURBINE INDUSTRY

A consortium of Danish universities and companies have come up with an idea that could save billions in the wind turbine industry. The aim of the project, named InnoMill, is to develop mobile machining cells for machining of large wind turbine cast steel components.

Increasing energy consumption

Globally the demand for cheap renewable energy increases, and therefore the wind energy industry struggles to lower the Cost Of Energy (COE) on wind turbines. To lower the COE the size of the wind turbines increases. Current components measures several metres, which causes transportation of components to become a bottleneck – both in terms of ability to fit them on the road, and the cost of transportation to and from machine shops.

Limiting transportation

One way of limiting the amount of transportation is to perform machining operations on-site instead of the current practice of moving components to large scaled machine shops. The InnoMill project aims to develop such mobile machining cells, but it will not be as straight forward as it may seem. The challenge lies in making the machine accurate enough to meet the high quality standards demanded by the wind turbine industry, since it will deflect and vibrate significantly during operation.

Solution strategy

The researchers believe that the challenge can be overcome by gaining knowledge of stiffness and vibrational levels in the system throughout the entire machining process. During development of the machine, thorough analyses of the stiffness and vibrations will be used to predict and avoid unsuitable machine designs and machining patterns. During machine operation, different values will be monitored to allow the machine control to adjust such that the quality standards can be fulfilled. Scientists hope that this will enable the machine to meet the stringent quality standards.

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The PhD project

The aim of this Ph.D. project is to develop the simulation models necessary to develop the machine. The models must be able to predict the behavior of both the component and the machining cell during the machining process. To obtain valid models a great deal of research regarding the sensitivity of the final quality to different factors such as loads, supports and temperature is needed. Research into efficient and precise flexible multibody simulation is also needed to make valid simulations of the entire milling process, that can be handled using the computational power available today.

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