Opleiding Werktuigbouwkunde

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COLLOQUIUM

Conform artikel 4.6.8 van het SSNS-wb.

Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

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een voordracht houden getiteld:

Diffuser Augmented Wind Turbines

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Summary:
One of the challenges in the realization of wind power is finding suitable sites to erect wind turbines. In urban areas, there is ample space to erect small wind turbines. However, small conventional wind turbines have low power output, making them less attractive from an economic perspective. To enhance the power output of a small wind turbine, it can be equipped with a diffuser.
The concept of equipping a wind turbine with a diffuser is long known and has been the subject of several theoretical and experimental investigations since the 1970's. These investigations tried to find a solution to the problems of optimal diffuser design and obtainable power augmentation. Albeit attempted these problems remained unsolved. The focus of the present investigation are these issues.
One-dimensional momentum theory for a conventional wind turbine results in a theoretical maximal obtainable power output known as the Betz limit. Analogously, a one-dimensional theory for a diffuser augmented wind turbine is derived. Based on the one-dimensional theory and based on a Computational Fluid Dynamics (CFD) model taking the effects of viscosity into account, it has been attempted to converge towards an optimal configuration of diffuser and turbine.
The best design of a wind turbine equipped with a diffuser, achieved in the current study, resulted in a significant power augmentation compared to a traditional wind turbine of the same rotor diameter. In terms of obtainable power output this augmentation is the equivalent of more than three times the Betz limit. Furthermore, it is shown that reported theoretical investigations are founded on incorrect assumptions and therefore lead to misrepresentation of the performance prediction of the concept.

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