Master Thesis

CFD-based calculation of wind loads on solar systems on building roofs

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Abstract

LEPOSOL GmbH is a start-up founded in Cottbus that specialises in the development and production of prefabricated solar energy systems. Our innovative complete photovoltaic systems are specially designed for commercial and industrial roofs and are characterised by their quick installation options. The folded Leporello-type systems are typically installed in an east-west direction. This already results in lower uplift forces than a south-facing orientation open to the north.

When engineering the LEPOSOL system, there are several design parameters, such as gap spacing, which have a strong influence on the wind forces acting on the system. The aim of the work is to determine which geometry minimises the forces that occur so that the effort required for ballasting or guying the system can be minimised. In addition, it is to be investigated which aerodynamic auxiliary surfaces can further reduce the wind loads.

Tasks

- Determination of the mechanically reasonable parameter ranges for dimensioning the solar systems
- Development of a CFD model to calculate the wind loads occurring on the solar system
- Systematic variation of the solar system geometry within the parameter ranges to calculate the maximum wind suction and pressure on different areas of the system, as well as the expected horizontal forces on the overall system with different positioning of the solar system on flat roofs
- Optional extension of the calculations to sawtooth roofs and gable roofs
- Investigation of the effect of different aerodynamic auxiliary surfaces (e.g. lateral panelling, eaves or gable ends) to reduce the forces acting on the solar system

Desired skills

- Solid knowledge of fluid mechanics
- Hands-on experience with computational fluid dynamics (CFD) software, preferably OpenFOA
- Proficiency in at least one higher programming language like Python, MATLAB, C/C++, Fortran
- Preferably a background in mechanical engineering with CAD/FEM-modelling skills
- Interest in solar energy applications

Contact

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