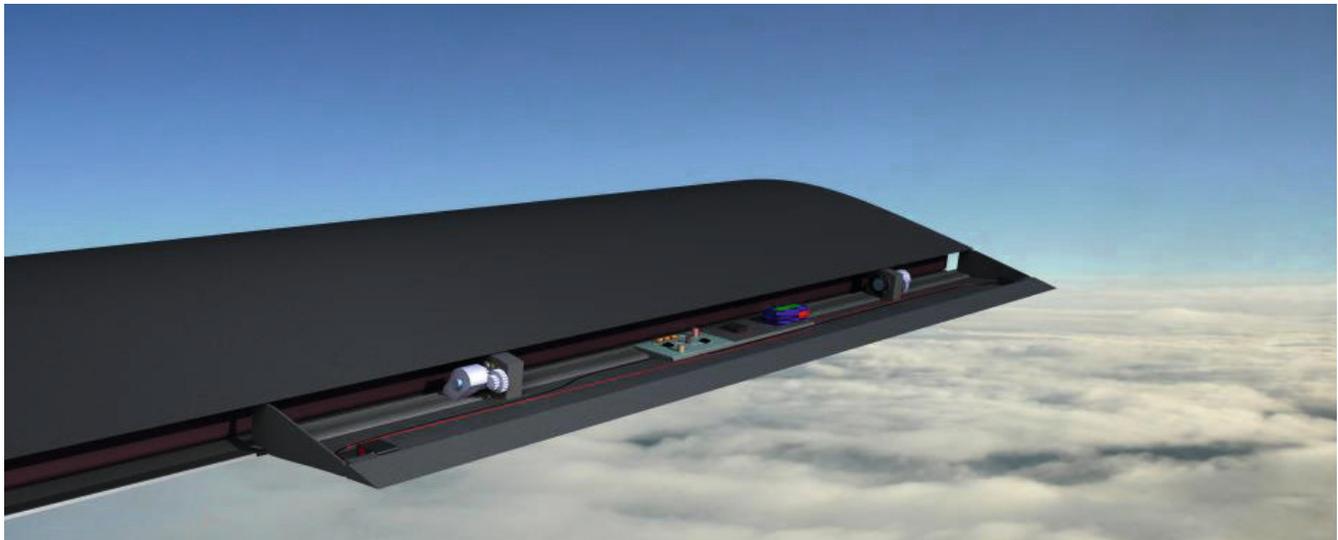


Fully autonomous free-floating flap for wind turbine blades and airplane wings



Active load alleviation is getting more and more important in the domains of aerospace and wind energy. Nowadays modern aircraft and wind turbine blades are equipped with means to actively alleviate loads. However, problems arise when it comes to designing controllers and installing actuators, cables and sensors.

One of the major problems in prior art solutions, in which controllable flaps are applied to blades for windmills or for aeronautic applications, is that maintenance is costly, particularly with windmill applications. A complete blade has to be dismantled, repaired and placed back into position. During the repair time the windmill is out of operation.

Plug and play

A team of TU Delft and Technion scientists succeeded in developing a trailing edge flap, which is equipped with its own controller, sensor and actuator. Moreover the power system comprises a piezoelectric generator that converts the natural vibrations

of the flap into electrical energy. This newly developed flap is fully autonomous and can be used as a plug and play solution. In case there is any need to apply service to the controllable flap, it can simply be removed from the blade. In this way the windmill can stay fully operational.

Easy data communication

Another major advantage, compared to prior state of art, is that data communication between rotating and stationary parts of the windmill, is easier. As the wind turbine blades rotate, in prior state of art solutions it is hard to transfer signals from the fixed hub to the rotating blades. Now that the entire system is on the blade, this TU Delft invention effectively deals with this difficulty, as there is no more need to transfer measurements or control signals between rotating and stationary parts of the windmill construction.

Weight reduction

As there is no more need for a large actuator in the turbine blade, a weight reduction of the actuator is realised in the order of 20% till 30%.

Due to the fact that a series of free-floating flaps is installed at each rotating blade, it somehow looks like a piano recital, when the system is operational.

This free-floating flap, that is unique because of the combination of local sensing, local control, actuation and energy harvesting, is very promising for wind turbine manufacturers and aircraft manufacturers.

Advantages

- Unique combination of local sensing, local control, actuation and energy harvesting
- Easy data communication
- Reduction of installation-, inspection- and maintenance costs
- 20-30% weight reduction of the actuator

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