" In about 2010 I started investing in an **adaptive rotor/propeller concept** for aviation.

It is not just another mechanical solution but one closely coupled with a mathematical proof providing guarantee of the following features:

1) Stall elimination

Near 100% elimination of blade stall originating from the difference between the actual airspeed (axial), and the design speed of the rotor/propeller;

2) Optimal tiltrotor solution

Thanks to their variable blade twist these rotors/propellers provide near optimal efficiency at both cruising flight and hover. Vertical takeoff, landing and hover performance can be achieved near to the level of regular helicopters. Maximal cruising speed (with the same proprotors) can come close to 0.8 Mach;

3) Standard actuation

Existing pitch control systems work to adjust optimal value of the propeller blade pitch at about the 70% point of the radius. The proposed adaptive blade structure can work using the output of such a control system. Based on the 0.7R control signal (including signals given as mechanical rotation or displacement) the proposed solution **will adjust optimal blade pitch** at each section **along the whole working radius**.

> **Note** that this latter option is very much different from what the traditional, stiff-bladed rotors and propellers can offer. While the control system (or the input from the pilot) will react to a changing airspeed by setting the new optimal pitch at the 0.7R point, blades with constant twist will have section pitch values different from the optimal, at all other points of the working radius. In most cases **stall will start spreading** both from the root and the tip of the blades, towards the 0.7R point.

4) Upgrade without major structural change

The coherence of the concept with the operation of the existing pitch control systems (described above in p.3.) is important to explain and to stress easiness of the upgrade process of aircrafts from traditional (i.e. stiff blade) rotors/propellers to adaptive propulsors.

> The **point to remember** is that both old and new rotors/propellers will have identical regimes of operation
>
> a) fully (i.e. along the full working radius) at design speed, and
>
> b) partially at all other speeds (100% correspondence remains at the 0.7R point).

Driving engine (or electric motor) will not experience any adverse difference in torque, after the propeller upgrade.

At the same the pilot and the aircraft are sure to start experiencing an increase in power, mainly at low speed (hover), and also when reaching closer to the top cruising speed of the aircraft - when adaptive propellers are used.

The above mathematical proof is extremely simple. It is based on high school level trigonometry, applied to the classic blade element method of propeller design. Description is given in the free eBook, which is downloadable at the stallfreepropellers.com website. "

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