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Even the finest variable pitch propellers lose thrust at low and high speed.

Watch the GIF why and how this happens.

Operation essentials:

1. RPM is kept constant. Value of tangential speed ( **medium green** ) depends on the radius;
2. As axial (cruising) speed ( **blue** ) value grows and decreases periodically
3. stiff blades are rotated ( by some **automatic regulation system, ARS** ) around their radial axis
4. so, the **AOA error** measured at **0,75R** remains **zero** always;
5. Resulting wind around blade sections is shown as a **vector field** ( **violet** ) of its speed;
6. At design speed ( axial/cruising speed = **Vdesign** ) vector field of the resulting wind is ALMOST fully aligned with the blade surface ( more exactly: with the surface made of chord lines of the blade sections ). There is a small difference though: at each section, between the chord line and the direction of the resulting speed, there is a small angle equal to the optimal value of the AOA ( **= AOAopt** );
7. AOAopt has a value of about 4 degrees, everywhere. It is quasy-constant along the radius and is **not shown** in the GIF;
8. When axial (cruising) speed ( **blue** ) is different from its design value, alignment of the blade surface with the resulting windspeed vector field starts deteriorating. Gaps appear everywhere except (due to the regulation) at the 0,75R blade section;
9. Excess AOA, that is AOA-errors are shown in the GIF, with **yellow** and **light green**;
10. **Stall** zones are marked in **yellow** color. Here AOA is greater than AOAopt;
11. Special cases of stall – when AOA is less than zero - are indicated by **light green** . These are the zones of **windmilling**;
12. Vector field of the resulting wind undergoes a **twist** (not rotation!) as a consequence of the changing axial speed;
13. Varying twist causes misalignment between the vector field and the blade surface – irrespective of the zero error maintained by the ARS at 0,75R all the time;
14. The problem is ARS uses rotation of the blade surface in attempt to align it with the twisting vector field of the resulting wind.