



Industrial Consultancy & Sponsored Research (IC&SR)

EXTERNAL ATTACHMENT TO INCREASE AERODYNAMIC EFFICIENCY OF A WING APPLICABLE FOR AEROPLANES, TURBINES, AND FANS
IITM Technology Available for Licensing

Problem Statement

- During flight, aircraft wings encounter **adverse conditions** besides take-off, landing and turning.
- The wings are equipped with **movable** flaps and ailerons that require **complex mechanism** to **displace** and/or **rotate** the whole assembly.
- The efficiency achieved by an aircraft depends on the shape of the wings and their sections. Hence, each aircraft is limited to a maximum lift during take-off and landing.
- The present invention provides a **high-lift device**, which operates as a simple external attachment that increases efficiency, range of flight and better fuel saving of any given aircraft.

Technology Category/ Market

Applied Mechanics: Wing(s) of aircraft/aeroplane;
Industry: Aerodynamics;

Applications: Aircraft wings, Turbines blade, rudder, rocket fins, Fan blades;

Market: The Aerodynamic market was valued at USD 22.80 billion in 2017, & is projected to reach **USD 32.77 billion** by **2025**, at a CARG of **4.77%** during the period of 2022 to **2029**.

Technology

- An **external skin** with several **micro fiber composite (MFC) strips** attached at different spanwise locations is attached to the leading edge of a wing and takes its shape.
- Electrical actuation of one or more MFC strips changes the curvature of the external skin resulting in a change in the aerodynamic coefficients of the wing.
- The change in shape is used to **control (delay/prevent) flow separation** at high angles of attack. This shape is predicted using a **decambering technique**.
- Using the **external skin**, an aircraft can operate at high angles of attack at an enhanced **coefficient of lift (C_L)** and increased range without any serious safety concerns and drag penalty (FIGs.1-4).

Images

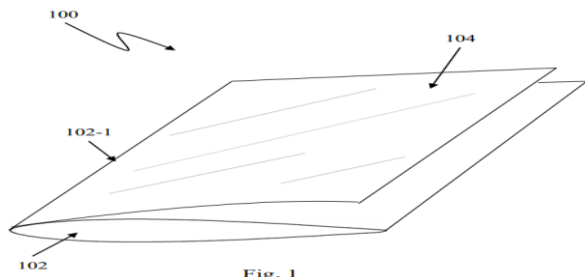


Fig. 1

FIG.1 Illustrates **3D Wing with external skin** attached to the leading edge of the wing

Intellectual Property

IITM IDF Ref. 2336;
IN Patent No.: 425424 (Granted)

Key Features / Value Proposition

❖ **Technical perspective:**

1. An **external attachment** takes the shape of the baseline wing (**rectangular/tapered**) of any section (**symmetric/cambered**).
2. Present invention describes a **3D external surface** which is **attached** at the **leading edge** and can **change its shape** both **along chord/section** and **wing-span**. It takes 3D effects into consideration during flight.

❖ **Industrial Perspective:**

1. Current invention increases **range of operation** and helps in **fuel savings**.
2. Present invention is a high-lift device that works at a **range of angles of attack (high and low)** with enhanced **lift forces**.

TRL (Technology Readiness Level)

TRL 3-4, Proof of concept ready stage

Research Lab

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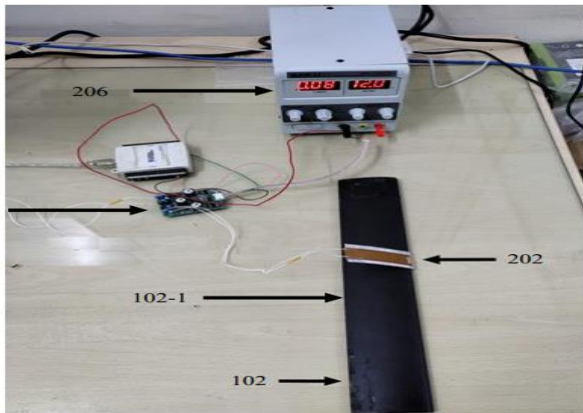


FIG. 2 Actuating a single Micro Fiber Composite strip from a plurality of MFC strips pasted on to the external skin attached at the leading edge of the wing.

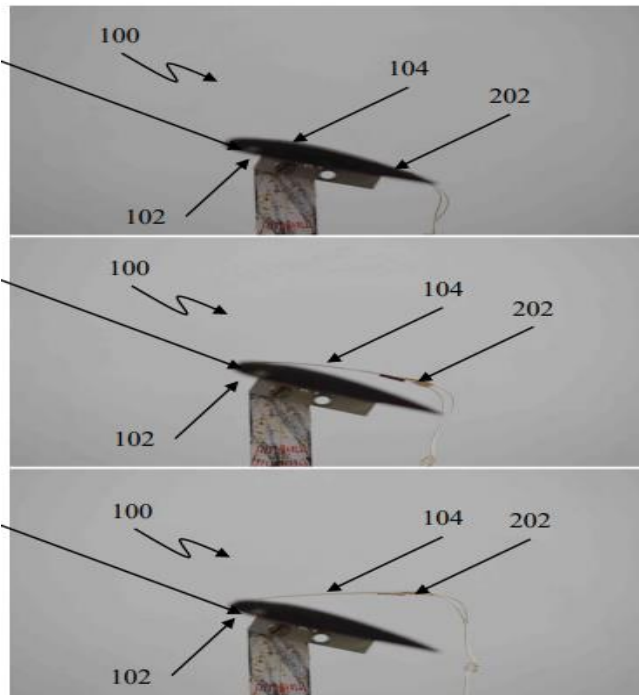
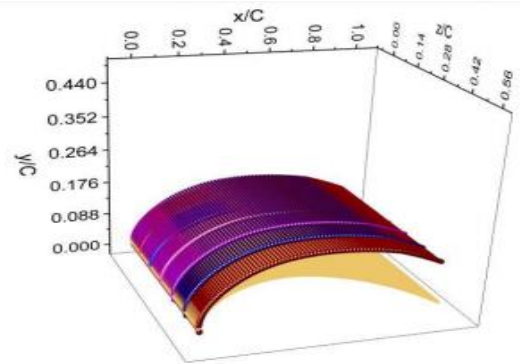
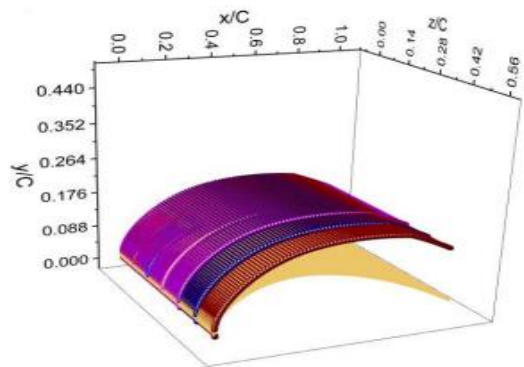


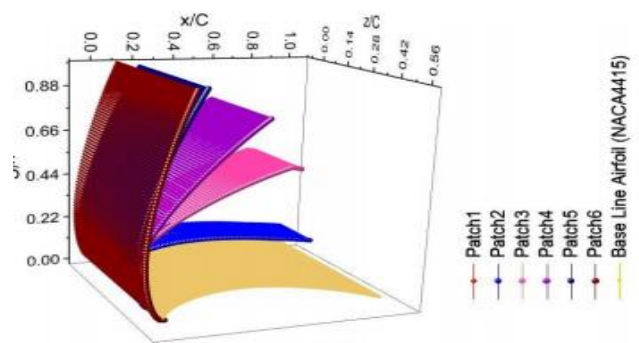
FIG. 3 External Skin deployed at the middle section of the wing.



(a)



(b)



(c)

FIG. 4 Numerically Morphed Surfaces showing different curvature along wing-span for Local Design 2D CI at Pre-Stall Angle of attack = 5°, Wing Angle of Attack: 5° for CL hikes: (a) 10% (b) 20% (c) 30%. Yellow colour is the baseline wing surface.

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