



Centro Italiano Ricerche Aerospaziali

Summary:

The concept was conceived to enable adaptive variations of the blade twist to increase the performance of the helicopter at specific regimes penalised by the conventional design in favour of more extended ones. The Shape Memory Alloy (SMA) technology was considered for this application, offering unique properties in terms of bearing loads and compactness of the actuation. These aspects, jointly with the capability of monitoring the strain level and reconstructing the current shape of the blade, represent the main innovative content of the system, that can be exploited for SMA training, pre-loading and actuation

Benefits:

Power saving in hover and vertical flight

Reliability of blade twist actuation due to the compactness of the technology

Structural module for fixed and rotary wing

Problem addressed:

Training and preloading of Shape Memory Alloy (SMA) compact actuators for the adaptive variation of the twist of the blades of the main rotor.

Proposed use:

Finalization of the pre-twist of solid rod or tubular SMA elements, integration within the blade structure and monitoring of the stress caused by the elastic recovery of the elements, the torsional actuation and the external loads (aerodynamic, inertial) a blade element usually undergoes

Technology overview:

The technology is based on a structural elastic part hosting a SMA solid element. A dedicated interface allows the application of a specific torque to drive the desired pre-twist within the SMA to suitably train the alloy. The same interface is then used to link the SMA element to the hosting structure with a desired twist angle. A sensed part of the structure then detects the strain level, in turn elaborated to obtain the stress level

Reference project:

Shape Adaptive Blades for Rotorcraft Efficiency, SABRE, H2020, 2017-2021.

Intellectual property information:

European Patent n. EP4095033 granted on 09.10.2024 (Unitary Patent).

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