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## Professor Solkeun Jee's research team investigates the correlation between the performance of helicopter blades and the phenomenon of air compression

- GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Mechanical Engineering Professor Solkeun Jee's research team has identified the negative effects of compressed air flowing around blades that is directly related to the stall\* phenomenon, which degrades the flight performance of aircraft wings such as helicopters and drones.

\* stall: a phenomenon in which flight performance is degraded due to decreased lift and increased drag

- When a rotorcraft such as a helicopter flies at high speed, there is a high possibility that a flow separation phenomenon occurs in which the flow falls off the blade. The main cause of flow separation\* include rapid pressure distribution changes on the surface and air compressibility effects due to high flow rates.

\* flow separation: phenomenon of fluid falling off the surface of a vehicle

- The flow separation phenomenon can be a direct cause for the stall of the blade and may cause vibration of the blade rotating at high speed as well as reducing thrust of the rotorcraft. Due to the blade stall, the flight range of the rotorcraft is limited, and a sudden stall can lead to a vehicle crash. Therefore, it is very

important for the rotorcraft blade design to understand the flow mechanism in which these blade stalls appear.

- Traditional wind tunnel experimental studies conducted on rotary-wing blades mainly measured the power produced by the blades. However, in these wind tunnel experiments, precise measurement of the flow phenomenon was difficult, making it difficult for a close analysis of the stall generation mechanism. In this study, the flow phenomenon around the wing could be analyzed in detail using turbulent simulation.
- A strong compressive effect was observed in the front part of the airfoil experiencing a sufficiently high flow velocity and angle of attack, and it was confirmed that a supersonic region (Mach 1 or more) was generated. The supersonic region created locally in the front of the airfoil\* produced a dynamic stall vortex, a flow phenomenon that causes blade stall.

\* airfoil: 2-dimensional cross-section of wings

- Professor Solkeun Jee said, "The results of this study have the greatest significance in identifying the local supersonic region caused by the compressive effect under the flow condition of the helicopter blade creates stall. This is expected to contribute to the prediction of aerodynamic performance of wings, which are key components of the aircraft that are developed in Korea, and the design of wings that are based on them."
- This research was conducted with the support from the National Research Foundation of Korea and the GIST Research Institute and were published on June 20, 2020, in *Aerospace Science and Technology*, a leading international journal in the field of mechanical and aviation.

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