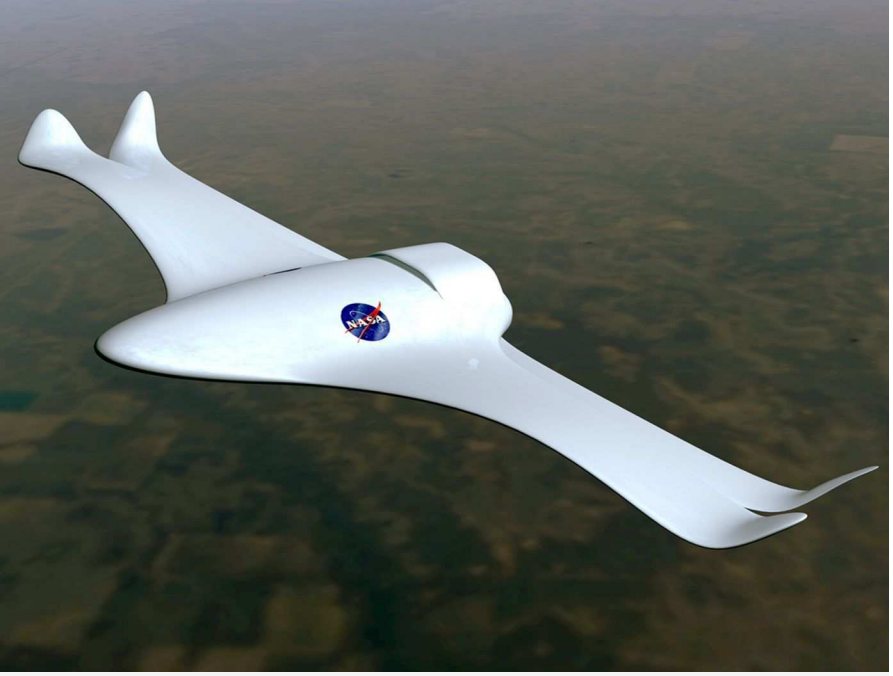


National Aeronautics and Space Administration

technology solution

Materials and Coatings

Composite Elastic Skins for Shape-Changing Structures

Elastic skins that can be tailored for specific applications

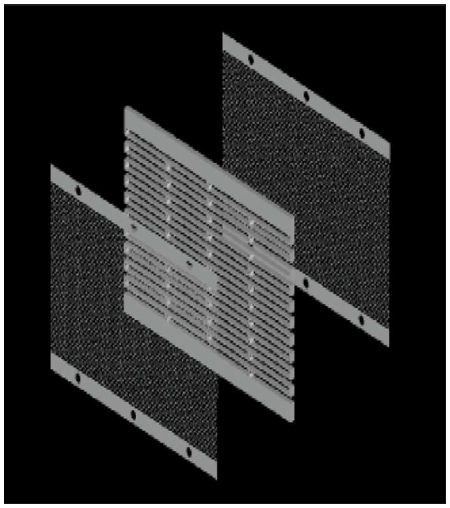
NASA Langley Research Center has developed composite elastic skins for covering shape-changing (morphable) structures. These skins are intended especially for use on advanced aircraft that change shapes in order to assume different aerodynamic properties. Examples of aircraft shape changes include growth or shrinkage of bumps, conformal changes in wing planforms, cambers, twists, and bending of integrated leading and trailing-edge flaps. Prior to this invention, there was no way of providing smooth aerodynamic surfaces capable of large deflections while maintaining smoothness and sufficient rigidity.

BENEFITS

- Skin can be stretched up to 20%
- Skin can be stretched or otherwise warped with low actuation force in one or both in-plane direction(s)
- Skin maintains sufficient smoothness and rigidity for aerospace applications

THE TECHNOLOGY

The composite elastic skin can include one or more internal skeletal layer(s) made of a metal or a suitably stiff composite. By use of water-jet cutting, laser cutting, photolithography, or some other suitable technique, regular patterns of holes are cut into the skeletal layers (see figure). The skeletal layers are thereby made into planar springs. The skeletal layers are embedded in a castable elastomer. The anisotropic stiffness of the skin can be tailored through choice of the materials, the thicknesses of the skeletal and elastomeric layers, and the sizes and shapes of the cutouts. Moreover, by introducing local variations of thicknesses and/or cutout geometry, one can obtain local variations in the anisotropic stiffness. Threaded fasteners for attachment to actuators and/or the underlying structure are inserted in the internal skeleton at required locations.



Skins skeletal layers which are embedded in an elastomeric sheet.

APPLICATIONS

The technology has several potential applications:

- Aerospace
- Automotive

PUBLICATIONS

Patent No: 8,899,563

More Information

National Aeronautics and Space Administration

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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