SELECTIVELY DEFORMABLE STRUCTURES FOR DESIGN OF ADAPTIVE WING SMART ELEMENTS AS PART OF ACTIVE AEROELASTIC WING CONCEPT

GENNADY AMIRYANTS

Central Aerohydrodynamic institute (TsAGI), 1, Zhukovsky str, Zhukovsky, 140180,Russia, stataer@tsagi.ru

FANIL ISHMURATOV

Central Aerohydrodynamic institute (TsAGI), 1, Zhukovsky str, Zhukovsky, 140180,Russia, stataer@tsagi.ru

VICTOR MALYUTIN

Central Aerohydrodynamic institute (TsAGI), 1, Zhukovsky str, Zhukovsky, 140180,Russia, stataer@tsagi.ru

VICTOR TIMOKHIN

Central Aerohydrodynamic institute (TsAGI), 1, Zhukovsky str, Zhukovsky, 140180,Russia, stataer@tsagi.ru

Abstract

The results of multidisciplinary research activities focusing on the "use of aeroelasticity" concept are presented. Development and evaluation of the potential of morphing airframe technologies based on Selectively Deformable Structures (SDS) is observed.

The principal scheme of large-scale SADE project demonstrator for the wind tunnel of TsAGI T-101 is shown. The principal tasks for demonstrator are wind tunnel tests, ground vibration and stiffness measurements to show main advantages of adaptive smart elements of the wing.

Keywords: Actively Morphing Materials, Smart High Lift Devices, Wind Tunnel Demonstrator

1. Introduction

This paper presents results of research activities based on finite element models by using MSC.Patran, MSC.Nastran, MSC.Marc and focusing on the "use of aeroelasticity" concept. Development and evaluation of the potential of morphing airframe technologies based on SDS - Selectively Deformable Structures as one of the promising concept for smart structures is investigated. It is important to be aware of the known fact in advanced composite design: stiffness, elasticity and strength are not scalar, but tensored properties. Therefore, it is possible to combine required strength and stiffness with selective deformability as perspective opportunity to design of adaptive wings.

result in a deflection along the direction of the acting load, with only a minimal deformation in the transverse direction. This effect is achieved through designing the internal structure as a special cellular network. The individual cell can be described essentially as moment-resisting frame. Deformations of this type of preferably composite structure may be resolved into two components: traction-contraction, and flexural deflections.

2. SADE Project of the 7th European Framework Program.

Central aerohydrodynamic institute, TsAGI, Russia takes active part in the international SADE Project of the 7th European Framework Program. Abbreviation SADE (SmArt High Lift DEvices for Next Generation Wing) means: smart elements of mechanization of a wing of following generation. The aim of the project is to increase aerodynamic quality (lift to drag ratio) and fuel efficiency of the future transport airplanes, while reducing noise