MODIFICATION OF FLUID FLOW ABOUT BODIES AND SURFACES THROUGH VIRTUAL AERO-SHAPING OF AIRFOILS WITH SYNTHETIC JET ACTUATORS

The present invention involves a system for altering the aerodynamic shape and/or fluid flow about a solid body. The preferred embodiment comprises an obstruction disposed on the solid body and extending outwardly from the solid body into the fluid flow over the solid body and a synthetic jet actuator embedded in the solid body such that said fluid flow over the solid body encounters the obstruction before the synthetic jet actuator. The synthetic jet actuator includes a jet housing defined by walls, the jet housing having an internal chamber with a volume of fluid and an opening in the jet housing connecting the chamber to an external environment having the fluid, and a volume changing means for periodically changing the volume within the internal chamber so that a series of fluid vortices are generated and projected in the external environment out of the opening of the jet housing. A synthetic jet stream is formed by the fluid vortices entraining the fluid of the external environment and is projected outwardly from the solid body. The fluid flow over the solid body contacts the synthetic jet stream forming a recirculation region, thereby modifying both the flow field and the pressure distribution and similarly modifying both the lift and drag characteristics of the solid body.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : B64C 21/08  
US CL : 244/208  
According to International Patent Classification (IPC) or to both national classification and IPC.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 244/208, 199, 200, 205, 198, 214, 204, 201, 207

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>Y</td>
<td>US 5,957,413 A (GLEZER et al) 28 September 1999 (28.09.1999), whole document</td>
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<td>US 5,758,823 A (GLEZER et al) 02 June 1998 (02.06.1998), whole document</td>
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<td>Y</td>
<td>US 4,563,684 A (MARIS) 7 January 1986 (07.01.1986), whole document</td>
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**Date of the actual completion of the international search**

15 July 2002 (15.07.2002)

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25 FEB 2003

**Name and mailing address of the ISA/US**

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