Test Cases for 1st AIAA LFC Transition-Prediction Workshop (2025-2026)

Three LFC Test Cases (each with detailed test-case description and necessary geometry information, input data sets, and analysis instructions) will allow participants to apply their boundary-layer and stability analysis methods.

Input data sets will be provided that include detailed boundary-layer profiles (and their derivatives) to be used as input to LST- and PSE-type analyses by participants using their own method(s). Participants are expected to use the boundary-layer profiles provided by the organizers ("CASE?.LST" or "CASE?.PSE" files – see below) to conduct the requested LST and/or PSE stability calculations.

Participants have the option to provide their own boundary-layer results for comparison by the organizers of selected profiles computed by participants.

Workshop Test Cases and Input Files

The following section provides summary information and links to the LFC test cases that have been prepared for the 1st AIAA LFC Transition-Prediction Workshop.

a. Location of LFC Workshop materials

Test Case description documents and input files will be available in separate subdirectories in the following server directory:

https://nasagov.box.com/s/hjkpg6f33fawiqbqutpaw5pft9qwvrkq.

b. Overview of LFC Workshop Test Cases

Test Case 1. Laminar boundary layer along a flat plate with suction

1. This test case is based on an atmospheric wind-tunnel test of a flat plate with suction at low freestream Mach number. The test was performed by DLR in the DNW-NWB tunnel in Braunschweig. Test Case 1 is based on measurement with a single chordwise suction panel for which pressure data, boundary layer data, suction data and transition data have been made available. Boundary-layer transition occurs well aft of the suction panel.
2. Laminar flow with 2-D Tollmien-Schlichting type flow instabilities.
3. Test Case Description, description input data sets and analysis instructions – filename "GSSC15_Case1_V1.pdf"
4. Data input files –

i. Boundary-layer profiles provided for stability inputs – filename "CASE1.BLI"
ii. Boundary-layer profiles (and derivatives) provided as inputs for LST stability analysis – filename "CASE1.LST"
iii. Boundary-layer profiles (and derivatives) provided as inputs for non-linear PSE stability analysis – filename "CASE1.PSE"

Test Case 2. Infinite-swept wing flow with prescribed suction distribution

a. This test case is for a simplified swept-wing configuration based on the NACA 64A010 airfoil with leading- and trailing-edge sweep angle of 40 degs with leading edge suction (HLFC) at high Reynolds numbers and transonic Mach number.
b. Laminar flow with both crossflow and Tollmien-Schlichting flow instabilities.
c. Test Case Description, input data sets and analysis instructions – links to: filename "GSSC16_Case2_V1.pdf"
d. Data input files –
   i. Boundary-layer profiles provided for stability inputs – filename "CASE2.BLI"
   ii. Boundary-layer profiles (and derivatives) provided as inputs for LST stability analysis – filename "CASE2.LST"
   iii. Boundary-layer profiles (and derivatives) provided as inputs for non-linear PSE stability analysis – filename "CASE2.PSE"

Test Case 3. Conical-swept wing flow with prescribed suction distribution

a. This test case is for a simplified conical swept-wing configuration based on the NACA 64A010 airfoil with leading-edge sweep angle of 40 degrees and trailing-edge sweep angle of 15 degrees with leading edge suction (HLFC) at high chord Reynolds numbers and transonic Mach number.
b. Laminar flow with both crossflow and Tollmien-Schlichting flow instabilities.
c. Test Case Description, input data sets and analysis instructions – filename "GSSC17_Case3_V1.pdf"
d. Data input files –
   i. Boundary-layer profiles provided for stability inputs - filename "CASE3.BLI"
   ii. Boundary-layer profiles (and derivatives) provided as inputs for LST stability analysis - filename "CASE3.LST"

iii. Boundary-layer profiles (and derivatives) provided as inputs for non-linear PSE stability analysis - filename “CASE3.PSE"

Description of Test Case Input Data Sets

This section summarizes three documents repeated in each Test Case subdirectory (see above) with description of parameter names, boundary-layer coordinate system(s) and formats of input data sets needed to conduct linear stability and/or non-local stability (PSE) computations (as well as optional boundary-layer analyses) for the LFC test cases:

a. Description of the Input Data for Boundary-Layer Calculations on Infinite-Swept and Conical Surfaces and Wings: filename “GSSC12_BL_input_format_V1.pdf”

b. Description of the Input Data for Linear Stability Calculations on Infinite-Swept and Conical Surfaces and Wings: filename “GSSC13_LST_input_format_V1.pdf”

c. Description of the Input Data for Non-Local Stability Computations on Infinitely-Swept Surfaces and Wings: filename “GSSC14_PSE_input_format_V1.pdf”

Workshop Output Results by Participants

Participants are requested to register with the Organizers: contact@schrauf.de and vijgens@frontier.com.

The organizers will provide link to a server subdirectory where each registered participant can upload their results files for the Test Cases. Each participant’s subdirectory will be accessible only by the participant and the organizers.

For further information, please contact: contact@schrauf.de and vijgens@frontier.com.