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RESEARCH CONCERNING THE VARIATION OF THE PRESSURE ON THE UNDERSURFACE AND THE SUCTION FACE OF THE WING

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Abstract: The variation of the pressure on the under-surface and the suction face of the wings become important at high speed. It is thus necessary to determine by calculation or in experiments this modification of pressure. This study presents some experimental determinations which consider the evolution of the pressure on a wing subjected to a air high speed jet. The system proposes to use sensors of pressure MPX12 and a USB based measurement and automation devices LabJack U12. The wing which is placed in a blower, allows using the sensors for the data acquisition in eight points. The LabView software makes it possible to trace a diagram on which one can indicate the placement of the sensors. Thus, one can visualize at the same time a graph with the evolution of the pressure and the values corresponding on the computer**.**

1. THE DESCRIPTION OF THE EXPERIMENTAL RIG

To collect the signals of the pressure which acts on the under-surface and the suction face of the wing, the surface of profiles is bored in new points (visible in the fig.1). The metal pipes fixed by welding are connected with the sensors by flexible tubes.
A powerful jet of air can be directed towards the wing profile (fig.2.).
To direct the air blast towards the surface of the wing, the conceived system allows the rotation of the unit (fig. 3).

Fig. 1. Wing's profile and the holes intended to collect the pressure

Fig. 2. The blower

Fig.3. Measurement chain

For the experimental determinations, the sensors are essential for collecting the signals of pressure, because, on the surface of wing can appear overpressures or depressions. The sensors must be able to determine the pressure for these two cases, the values being sometimes small. We have chosen silicon piezo-resistive pressure sensor type - MPX12. The pressure range is from 0 to 10 KPa which corresponds to our requirement. Such a sensor is depicted in figure 4.

Fig. 4. MPX12 Sensor

The sensors are placed on a printed circuit board. A filtering capacitor was used to ensure the quality of the signals in the process of measurement. The unit which contains the sensors intended for the collecting of the pressure is visible in the fig. 5.

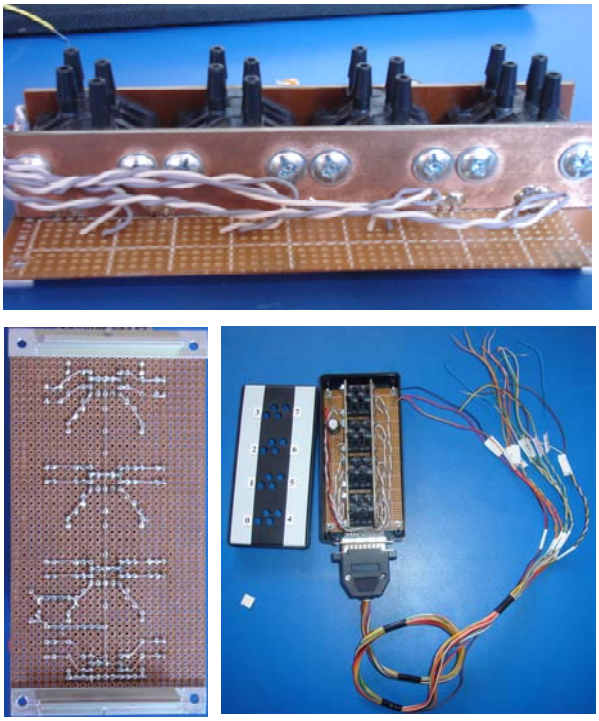

Fig.5. Mounted sensors on circuit board

The sensors are connected to an acquisition device LabJak U 12 which carries out an analogical data conversion into numeric signals. These signals are transmitted via USB to the computer. LabWiew software logs the data and at the same time carry out a graph with the signals of the pressure.
The image of this interface is in figure 6. The supply voltage is of +5V. DAQ - card LabJack U12 contains 16 ports DIO and 8 ports AI for entries in differential mode.

Fig. 6. Data acquisition device LabJack U12

Once the unit carried out, the measurement begins with the calibration of the sensors. For that we used the LabWiew software. In this software, in the block-diagram of application (see figure 7) we modified certain values by holding count of the indications given by a pressure gauge of high degree of accuracy.

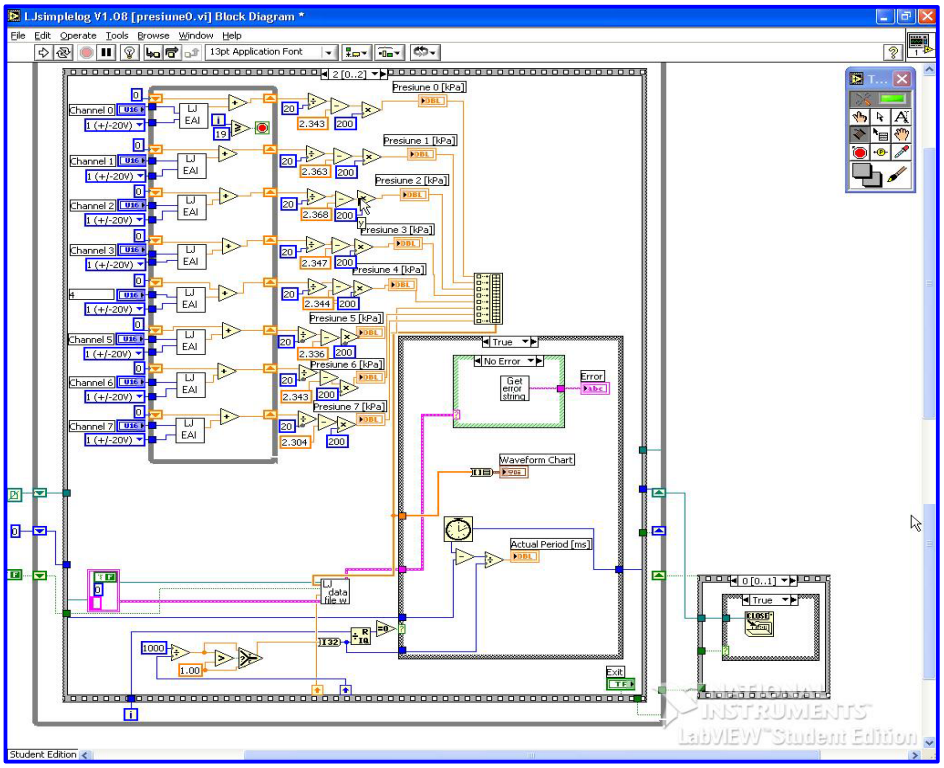

Fig.7. Block diagram

The complete rig which comprises the blower, the wing (inside the tube), eight sensors MPX12, LabJack U12 acquisition card and the computer is represented below in figure 8.

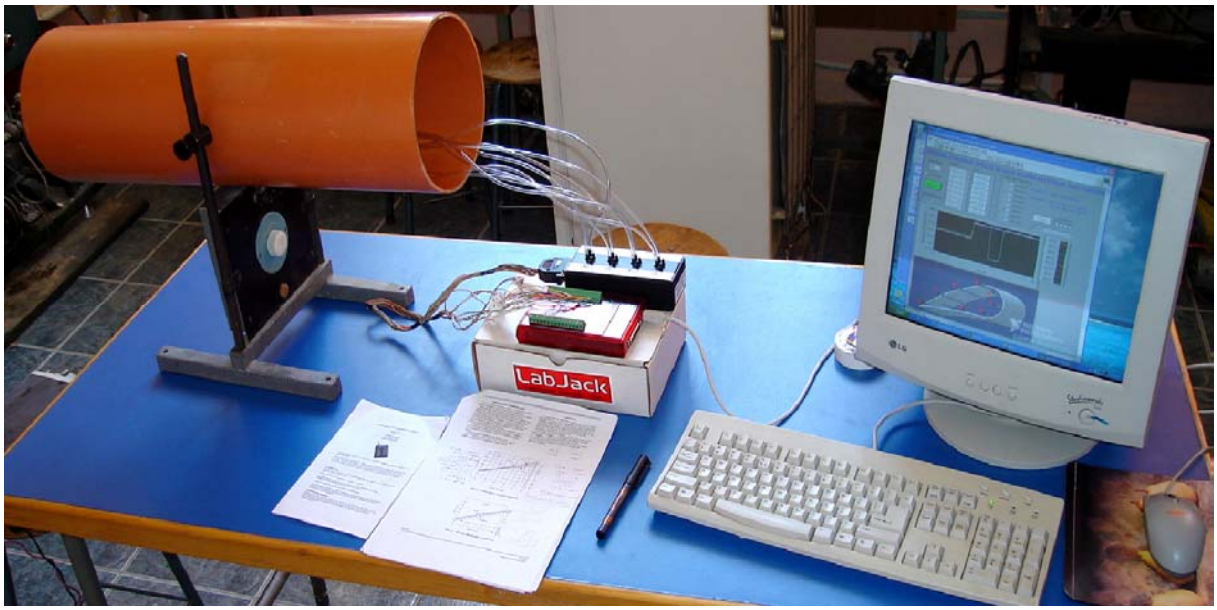

Fig.8. Data acquisition system

2. THE EXPERIMENTAL RESULTS

The wing placed in a tube 0.8 m length and diameter of 0.2 m was subjected to a blast of air of variable pressure. The jet was then generated by a flat convergent nozzle visible in figure 2. According to the position of the wing chosen by rotation, we can obtain the modification of the pressure on the under-surface and the suction face. An example of these results is in figure 9.

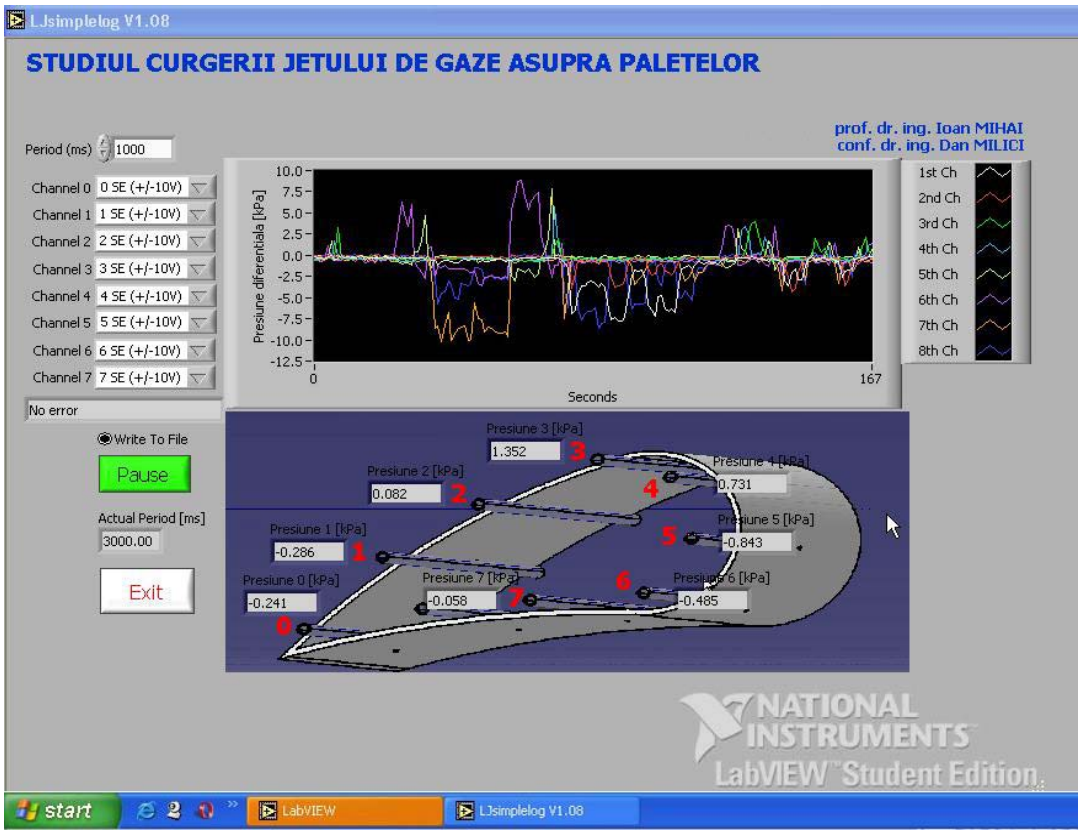

Fig.9. Experimental results for various positions of the wing in the wind channel

3. CONCLUSIONS

In this study we present a data acquisition system for pressure sensors sensing different points on a wing. The results of figure 9 indicate (see values) positive and negative values which correspond to the real case. Such a system indicates that one can determine pressures with the smallest values on the wing.

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