# EXPERIMENTAL DETERMINATION OF THE PRESSURE GAIN COEFFICIENT OF A FLUID BISTABLE ELEMENT WITH JETS OF DIFFERENT PHYSICAL NATURE

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***Abstract:*** The paper presents the experimental study regarding the pressure gain coefficient variation of the wall - attachment device. The examined bistable element is a special device with an incompressible fluid as supply jet and compressible fluid as command jet. In the technical literature no information was give regarding this problem.

***Key words*:** bistable element, pressure gain coefficient, supply jet, command jet

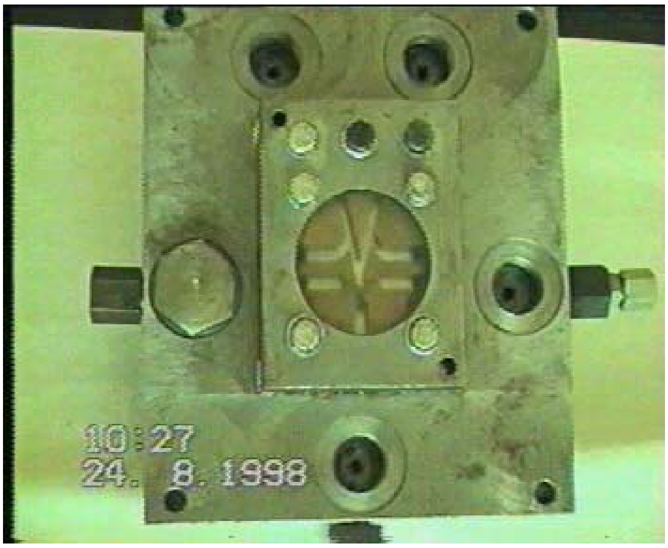


**Fig. 1**
*Distributing plate with the model of fluidic element*

## 1. INTRODUCTION

The actual orientation of the researches in the „Fluidics" field, internal and international, aims to achieve fluidic elements and systems with a minimal energy consumption a great speed of response, high reliability, safety in operation, a higher level of compatibility with the conventional automation systems, a lower price, in the end, performances that justify their usage.

The paper presents the experimental analysis concerning the pressure retrieved on the two branches of the bistable element reacts under the variation conditions of the entering dimensions (respectively the supply jet pressure and command jet pressure [2], [3], [4].

This allowed the comparative analysis of the pressure gain coefficient variation, as an important stationary performance of the fluidic amplifier. The stand, distributing plate with the three models of fluidic elements (fig. 1) made for experimentation allowed the performance of some measurements that led to some conclusions concerning constructive and functional aspects of the used fluidic bistable.

Taking into account the electropneumatic analogy, admitting a stationary model of the system, made up of impedances proper to each subsystem, a relation of performances dependence can be found out, depending the geometrical and functional parameters of the system.

For a symmetrical system, the power jet of [$Q_a$, $p_a$] parameters is totally received on a receiving canal. The recovery in flow and pressure is established by taking into account only the resistance effect of the impedances suitable to supply spout $Z_a$, exhaustion $Z_{eş}$, receiving canal $Z_r$ and charge $Z_s$ [5].

Writing down the exit flow $Q_e = Q_r$ as recovered flow, we can express [6] *the gain coefficient in flow* $C_{rq}$ :

$$C_{rq} = \frac{Q_r}{Q_a} = \frac{Z_{eş}}{Z_{eş} + Z_r + Z_s} \quad \text{or:} \quad C_{rq} = \frac{1}{1 + \frac{Z_r}{Z_{eş}} + \frac{Z_s}{Z_{eş}}} \quad \text{equivalent with:}$$

$$C_{rq} = \frac{1}{1 + \frac{R_r}{R_{eş}} + \frac{R_s}{R_{eş}}} \tag{1}$$

and the pressure gain coefficient $C_{rp}$ :

$$C_{rp} = \frac{p_r}{p_a} = \frac{1}{\left(1 + \frac{R_a}{R_{eş}}\right)\left(1 + \frac{R_r}{R_{eş}}\right) + \frac{R_a}{R_s}} \tag{2}$$

In relations (1) and (2) we can observe that the recovery in pressure and flow is sub-unitary. If we take into account the flow rate drove by the power jet it is possible for the flow recovery to outrun the unity.

## 2. EXPERIMENTAL STUDY OF THE PRESSURE GAIN COEFFICIENT

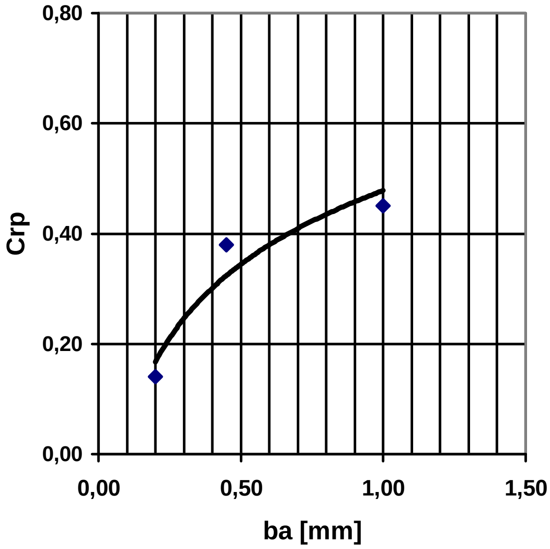


**Fig. 2** *Variation of the pressure gain coefficient with the growth of the power spout breadth*

The special fluidic device discrete action, theoretically studied in this paper, has a geometrical structure inspired by an amplifier design for supersonic compressible fluids, studied by F. Bavagnoli, an Italian [1]. This power amplifier is represented through the fluidic device of the symmetrical bistable element type, basing on the principle of jet attachment to solid walls – the Coanda effect. Its particularity stands in the fact that it uses a liquid supply jet and air control jets [4].

The experimental data obtained allow the analysis of the pressure gain coefficient variation depending on the supply jet section.

For the same value of the supply pressure, constantly maintained, for example $p_a=4,5\times10^5$Pa, respectively of the command jet $p_c=1,6\times10^5$Pa the pressure coefficient was calculated for the three fluidic elements. Then, figure 2 highlights the increase of the pressure gain coefficient $C_{rp}$ at the same time with the growth of the power spout breadth.

## 3. CONCLUSIONS

- We can observe the increase of the pressure gain coefficient $C_{rp}$ at the same time with the power spout breadth. The experimental result is the same with the theoretical one (presented in the paper THEORETICAL ANALYSIS OF THE PRESSURE GAIN COEFFICIENT OF A SPECIAL WALL – ATTACHEMENT DEVICE) concerning the tendency of variation of the pressure gain coefficient depending on the power spout breadth.

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