EXPERIMENTAL INVESTIGATIONS OF THIN WALLED, SQUARED CROSS – SECTION COMPOSITE TUBES APPLIED TO STATIC COMPRESSION

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1. ABSTRACT

This paper deals with the experimental investigations of thin-walled, squared cross-section composite tubes subjected to a static compression. The main purpose of this paper is to present and discuss different methods of data analysis while investigating stability of thin-walled structures. Performed experiments were conducted by employing Zwick/Roel universal test stand; non-contact, geometrical - optical principled system Aramis produced by GOM company and strain-gauge technique. Different methods of determining buckling loads were employed, discussed and compared. Moreover all problems, occurring during experiments and data analysis were emphasized in order to show what kind of difficulties could appear during processing the results of measurements. As an example, comparing non-dimensional strain-gauges data with dimensional non-contact system Aramis results of measurements can quoted.

2. SCOPE OF THE RESEARCH

Tests were performed on composite, thin-walled columns with square cross-section with dimensions presented in the Fig. 1. Walls were made of 8th layered GFRP prepreg tape.
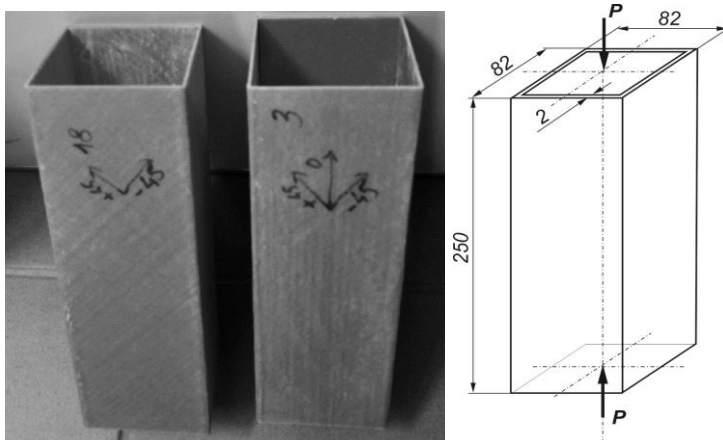

Fig. 1. Considered columns with their dimensions

Following six different layer arrangements of the plies were considered:

- $[45^o/-45^o/45^o/-45^o]_S$
- $[45^o/-45^o/0^o/0^o]_S$
- $[45^o/-45^o/45^o/0^o]_S$
- $[45^o/-45^o/45^o/0^o/0^o/-45^o/45^o/-45^o]_T$
- $[0^o/45^o/-45^o/45^o/-45^o/45^o/-45^o/0^o]_T$
- $[-45^o/45^o/45^o/45^o/-45^o/-45^o/-45^o/45^o]_T$.

Buckling loads were determined on the basis of the two main methods [1], [2]:

- inflection point method,
- $P\text{-}w^2$ method.

Moreover applicability of this two methods and others was discussed. In Fig. 2. is an example of limited applicability of some methods, as well. The paper tries to answer how to deal with such a problem.
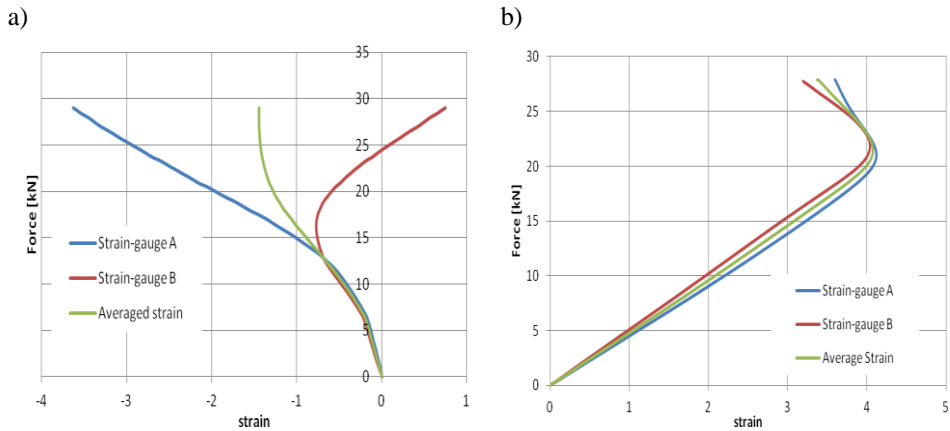
a)   b)

Fig. 2. Exemplary strain - load relationship for possible (a) and impossible (b) application of Averaged Strain Method

REFERENCES

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[2] Singer J., Arbocz J., Weller T., Buckling experiments. Experimental methods in buckling of thin-walled structure. Basic concepts, columns, beams, and plates, vol. 1. New York: John Wiley & Sons Inc., 1998 (vol. 2, 2002).