AN APPLICATION OF DIMENSIONAL MODEL THEORY IN THE DETERMINATION OF THE DEFORMATION OF A STRUCTURE

Ioan Száva*, Thomas Szirtes**, Péter Dani*

This paper presents an adroit utilization of dimensional analysis-based model theory by which the deformation of a structure – however complex – can be elegantly and easily obtained. The structure is loaded by a concentrated lateral load of arbitrary location and magnitude. The relevant technique is outlined in some details; therefore the reader is advised to follow the presented routine closely. By doing so, he will be impressed by the prowess and economy of the described process. In the Preamble, the more important relevant theorems and relations – without proofs – are given in greatly condensed forms. This summary will help the reader to understand the subsequent application presented. Full treatment of the theories and practice of applied dimensional model theory can be found in [1], which the interested and motivated reader is advised to consult.

Key words: *dimensional analysis, model law, prototype, model, displacement, reticular structure*

1. Preamble

1.1. Dimensional Matrix (DM) and Dimensional Set

The elements of the *Dimensional Matrix* (DM) are the *exponents* of the respective dimensions of variables. The rows of the DM are the dimensions, the columns are the *variables*. Thus, if M [kg] is mass, p [kg/(m s^2)] – pressure, v [m/s] – linear speed, g [m/s^2] – gravitational acceleration and Q [m^2 kg/s^2] – energy, then the DM is the **A** and **B** matrices combined (Fig. 1).

	M	p	v	g	Q
m	0	−1	1	1	2
kg	1	1	0	0	1
s	0	−2	−1	−2	−2
π_1	1	0	2	0	−1
π_2	0	1	6	−3	−1

(a)

m		
kg	**B**	**A**
s		
π_1	**D**	**C**
π_2		

(b)

Fig.1: The Dimensional Set (a) and its **A**, **B**, **C** *and* **D** *matrices (b) (the Dimensional Matrix is the* **A** *and* **B** *matrices combined)*

* prof.dr.eng. I. Száva, research engineer P. Dani, Transilvania University of Brasov, Faculty of Mechanical Engineering, 500 122-Brasov, B-dul Eroilor nr. 29, Romania

** Ph.D., P.Eng. T. Szirtes, President, Thomas Szirtes and Associates, Inc., 790 Cummer Avenue Toronto, Ontario, Canada M2H 1E7