Multivariate correspondence analysis in optimization historic studies of concrete bridges

V Yepes, A Marmaneu, F González-Vidosa and J V Martí

Instituto de Ciencia y Tecnología del Hormigón (ICITECH)
Universitat Politècnica de València (UPV), 46022 Valencia, Spain
Email: vyepesp@upv.es, almarme1@cam.upv.es, jvmartia@upv.es

ABSTRACT

The socio-cultural situation in which we find ourselves today, with limited budgets, greater awareness of the environment and high levels of gas emissions into the atmosphere, makes the future in general and the construction of structures in particularly aimed at finding designs that are more efficient. Since the 60s of last century to the present, some research groups spread across the five continents have tried to carry out optimization studies of concrete bridges, either the bridge in general and some of its elements in particular, publishing articles in scientific journals world-class, for example [1]–[5]. The featured paper extracts some qualitative variables defined and parameterized by reading that articles published over the years and it makes a simple multivariate correspondence analysis (SMCA). A sample of 93 articles has been analyzed and five variables has been extracted from its. The two overall objectives are to determine whether the dependency relationships between different categories that the variables can take are statistically significant and to define possible new lines of research. Therefore, SMCA is divided into 10 pairs of variables namely ten independent studies. The software used has been IBM SPSS Statistics 21. The results show that the type of optimization problem resolution are related to the development of technology and computers, that genetic algorithms [6] are related with maintenance phase, or that the optimization design of I-beam bridges is related with prestressed concrete among other. Finally, the thesis concludes that the optimization concrete bridge in construction phases or with special type of concrete could be new lines of research.

REFERENCES

[1]   J.V. Martí, F. González-Vidosa, V. Yepes and J. Alcalá. *Design of prestressed concrete precast road bridges with hybrid simulated annealing*, Engineering Structures, 2013, 48, 342-352.

[2]   V. Yepes, J. V. Martí, and T. García-Segura, "Cost and CO2 emission optimization of precast-prestressed concrete U-beam road bridges by a hybrid glowworm swarm algorithm," *Autom. Constr.*, 2015.

[3]   J.V. Martí, V. Yepes, F. González-Vidosa (2015). Memetic algorithm approach to designing of precast-prestressed concrete road bridges with steel fiber-reinforcement. Journal of Structural Engineering ASCE, 2015, 141(2): 04014114.

[4]   J. V. Martí, T. García-Segura, and V. Yepes, "Structural design of precast-prestressed concrete U-beam road bridges based on embodied energy," *J. Clean. Prod.*, vol. 120, pp. 231–240, 2016.

[5]   V. Yepes, T. García-Segura, and J. M. Moreno-Jiménez, "A cognitive approach for the multi-objective optimization of RC structural problems," *Arch. Civ. Mech. Eng.*, vol. 15, pp. 1024–1036, 2015.

[6]   J. H. Holland, "Adaptation in Natural and Artificial Systems," in *The University of Michigan Press*, 1975, vol. Ann Arbour.