XXI INTERNATIONAL SCIENTIFIC-EXPERT CONFERENCE ON RAILWAYS
RAILCON '24
October 10-11, 2024; Niš, Serbia

Thesis paper DOI: 10.5937/Railcon24155S

BIOMIMICRY AS A METHOD FOR AERODYNAMIC TRAIN DESIGN

Student: Pavle SAVIĆEVIĆ [1]
Mentor: Jovan TANASKOVIĆ [2] [0000-0002-2936-5535]

Abstract *– The aim of this thesis is to provide a broader picture that refers how to overcome one of the greatest and most challenging problem that will always remain relevant—solving the issue of aerodynamics in a traction rail vehicle, considering that air resistance accounts for 80% of the total traction resistance. The entire topic will be addressed through the design of trains inspired by nature, respecting its laws. We will return to that primordial view of the world, which provides answers to all questions. Biomimicry is the process of observing natural phenomena, flora, and fauna as models for sustainable design and engineering of various products and processes. In recent years, nature-inspired design has become a popular term. However, the idea is not new. Many technologies we use today are based on the principles of biomimicry. Biomimicry is no longer just a subject of study for scientists and academics. Many companies are now beginning to realize the potential benefits of biomimicry and are incorporating it into their business plans. One example of biomimicry in high-speed train design is replicating the shape of the kingfisher's beak to improve the aerodynamics of the train's front end. The long, aerodynamic beak of the kingfisher allows it to dive into water with minimal splash, thanks to its shape. By designing the front of the train to mimic the shape of the kingfisher's beak, engineers were able to reduce air resistance and noise, improving the overall performance of the train. This also solved the problem of the loud sonic boom that occurred when the train exited tunnels due to air pressure. Similarly, some engineers in Japan thought it would be interesting to apply the wing-folding mechanism of owls to improve the pantograph lowering mechanism, a device that draws electrical power from the overhead wires. Trains today move at extremely high speeds, constantly in the presence of the ground, nearby structures, and people, as well as passing through tunnels—all of which have always been challenges for aerodynamicists. Therefore, resorting to biomimicry as a method for aerodynamically designing trains has been characterized as a brilliant solution.*

Keywords – high-speed trains, biomimicry, aerodynamics, solutions.

[1] Faculty of Mechanical Engineering, University of Belgrade, Serbia, pavle.savicevic3@gmail.com
[2] Faculty of Mechanical Engineering, University of Belgrade, Serbia, jtanaskovic@mas.bg.ac.rs