

# Improving the performance of vertical slotted breakwater and modeling its hydrodynamic behavior by genetic programming

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**Abstract:** Due to the increasing importance of the marine environment, permeable breakwaters with water permeability, simple structure and compatibility with the environment have attracted the attention of engineers in recent decades (Li et al. 2022). Considering the capability of water passing through these structures, the challenge is to absorb the energy of the waves before entering the protected area behind the breakwater. These mechanisms are generally classified into two categories: reflection of waves at the structure's base and loss of wave energy in the absorber chamber of these breakwaters. However, reaching the level of confidence required to protect the port has always been a challenge in this type of breakwater and has caused these breakwaters to be in the research and development stage.

To solve this problem, this research studies the hydrodynamic behavior of a simple two-plate permeable breakwater along with two improved examples of this breakwater to improve the performance of this type of standard breakwater. The first upgraded example is a double-sided breakwater filled with rockfill materials in the absorbent chamber, and the second example is a combination of rockfill materials and geotubes on the rockfill materials.

For all three breakwater samples, the behavior graphs of the breakwater have been drawn against the influencing parameters. Also, according to the ability of the genetic programming regression model (GP) in modeling non-linear systems (Gandomi and Alavi 2011), the hydrodynamic behavior of these breakwaters has been modeled and the extracted mathematical relationships have been presented for the use of engineers. In addition, by sensitivity analysis, the effect of different parameters on the hydrodynamic behavior of the breakwater has been obtained for each breakwater.

The results show an improvement in the performance of the simple double-plate breakwater by increasing the rockfill materials. Also, this performance can be improved by adding a geotube on top of rockfill materials, although the amount of wave reflection will also increase in both breakwaters.

## REFERENCES

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