Modelling the edge breakout shear capacity of single anchors using gene expression programming

- Oladimeji Benedict Olalusi,
- Avishkar Durgapershad,
- Paul Oluwaseun Awoyera &
- John Temitope Kolawole

Abstract

The use of soft computing techniques is becoming more common in providing solutions to complex engineering problems such as the concrete breakout strength of anchor. Available techniques include semi-empirical equations that are known to over or underpredict and some soft computing techniques that is incapable of generating predictive equations. This study proposes a gene expression programming (GEP)-based mathematical model to predict the concrete edge breakout capacity of single anchors loaded in shear. In doing so, an experimental database compiled by the American Concrete Institute (ACI) Committee 355, containing 366 samples, was used for the model training and testing. The independent variables considered in the model development are the edge distance, anchor diameter, embedment depth and concrete strength. Moreover, the predictive performance of the developed model was compared to that of the existing models proposed in ACI 318 and the Eurocode 2 (EC2) design standards. The assessment showed that the proposed GEP-based model provided a much more uniform and accurate prediction of the actual strength than the models in the existing design standards. The proposed mathematical model is simple and robust and is expected to be very useful for evaluating the concrete breakout shear capacity of single anchors in pre-planning and pre-design phases; that is, towards inclusions in design standards.

Data availability

The datasets generated during the current study are available from the corresponding author on request.