



The use of the percentile method for searching empirical relationships between compression strength (UCS), Point Load (I_{s50}) and Schmidt Hammer (R_L) Indices

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I_{s50} and R_L indices are commonly used to indirectly estimate the compression strength of a rocky deposit by in situ and in laboratory devices. The widespread use of Point load and Schmidt hammer tests is due to the simplicity and the speediness of the execution of these tests. Their indices can be related to the UCS by means of the ordinary least square regression analyses. Several researchers suggest to take into account the lithology to build high correlated empirical expressions ($R^2 > 0.8$) to draw UCS from I_{s50} or R_L values. Nevertheless, the lower and upper bounds of the UCS ranges of values that can be estimated by means of the two indirect indices are not clearly defined yet. Aydin (2009) stated that the Schmidt hammer test shall be used to assess the compression resistance of rocks characterized by $UCS > 12-20$ MPa. On the other hand, the Point load measures can be performed on weak rocks but upper bound values for UCS are not suggested. In this paper, the empirical relationships between UCS, R_L and I_{s50} are searched by means of the percentile method (Bruno et al. 2013). This method is based on looking for the best regression function, between measured data of UCS and one of the indirect indices, drawn from a subset sample of the couples of measures that are the percentile values. These values are taken from the original dataset of both measures by calculating the cumulative function. No hypothesis on the probability distribution of the sample is needed and the procedure shows to be robust with respect to odd values or outliers. In this study, the carbonate sedimentary rocks are investigated. According to the rock mass classification of Dobereiner and De Freitas (1986), the UCS values for the studied rocks range between "extremely weak" to "strong". For the analyzed data, UCS varies between 1,18-270,70 MPa. Thus, through the percentile method the best empirical relationships UCS- I_{s50} and UCS- R_L are plotted. Relationships between I_{s50} and R_L are drawn, too. Finally, the goodness of the plotted empirical expressions have been checked through couples of measures selected from the original dataset and not used to search for the empirical relationships.

References

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