Evaluation of Selected fUnctional pRoperties of concrete industrial Flooring surface lAyers based on nondestruCtive tEsting using Artificial Intelligence. (SURFACE AI)

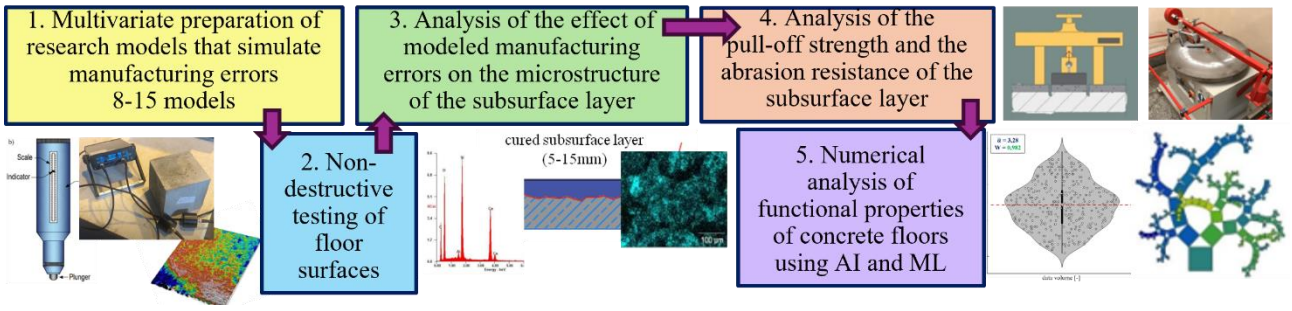
1. Aim of the project

The main purpose of the project is the detailed identification and evaluation of the functional properties of concrete floors with a Dry Shake Topping layer, using nondestructive methods supported by artificial intelligence techniques. Industrial floors with improved surface layer properties are often used in large industrial halls. Floors of this type are designed to meet durability and comfort requirements for a minimum of 25 years. It is estimated that the cost of industrial flooring is about 20% of the total cost associated with the construction of an industrial hall. It can be said that the basic performance characteristics of floor surfaces are abrasion resistance and pull-off strength of the subsurface layer. The selection of a suitable method of improving the top layer of a concrete floor becomes problematic due to technological regimes often defined in an approximate manner. This is often followed by execution errors that cause damage such as delamination, cracking or detachment of the subsurface layer.

2. Description of the reasons for undertaking this research topic

To enforce confirmation of the performance of concrete floors, it is necessary to use destructive or semi-destructive tests. Abrasion resistance tests and subsurface pull-off tests cause damage to the top layer of the floor, which, especially in active industrial, warehouse or commercial facilities, is not a desirable effect. Care must be taken to ensure an adequate number of measurements so that the test is representative. An example of this is the pull-off method, in which 1 measurement per 3 m2 of floor is required, which for a 25 x 120 meter hall gives 1000 measurements. Such a test will shut down production in the hall for more than 2 months. To this must be added the time and costs associated with repairing the areas sampled. In response to the tests presented here, there are complementary methods from the non-destructive testing division that evaluate often indicative values of strength properties. Acoustic and sclerometric methods, among others, are used. In addition, studies of the morphology of the surface layer can also provide additional information on the floor's performance. Due to the high inaccuracy, the given methods are treated as secondary, but with the use of artificial intelligence, it is possible to achieve a sufficiently high accuracy (90-95%) when evaluating strength parameters. The range of applications of artificial intelligence is so wide that it is also used to modify the ways of determining the mechanical properties of cementitious composites. Machine learning already supports, among other things, methods for determining the compressive strength, pull-off strength and abrasion resistance of cementitious composites.

3. General research plan



4. The most important expected results

The conducted tests of abrasion resistance and subsurface pull off strength and analyses of modifications of DST technology and microstructure of surface morphology will allow to answer the following questions: is it possible to completely or significantly (at least 90%) eliminate destructive methods from the process of evaluating selected performance properties of concrete floors; What is the real impact of selected and classified execution errors on the performance properties of concrete floors? How does the microstructure of the subsurface layer change as a result of the Dry Shake Topping technology modification; Is there a correlation between surface morphology and abrasion resistance for selected surfaces? The answers to these questions can benefit not only researchers and engineers identifying the functional properties and morphology of concrete floors. The research and analysis conducted is also a promising option for the industrial sector, which is keen on a non-invasive approach. The innovative research nature of the project is highlighted by the use of machine learning techniques and the planned unconventional use of the tools indicated.