

ANALYSIS OF STRENGTH of CONCRETE WITH THE ASPECT OF WATER-CEMENT VALUE

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ABSTRACT

On the characteristic and the quality of hardened concrete influences down the factor. The very important deposit represents the relationship of cement and the line so-called water-cement value. Testing shows that by constant contents of cement and generators (on the type and amounts) as well as by the same procedure of building into, guilty which are determined the dependence between the strength of concrete and the amount water has a form of are presented on the Figure 1.

In this paper is given analyses of terms of strength of concrete by the pressure and the water-cement value based on experimental testing of single samples and databases of the collected in the factory of concrete.

Data from the database have been classified in the dependence of the amount of cement in five groups (200,250,300,350,400 the kg). Are chosen amount of cement are most frequently are applied the amount of cement in the practical implementation.

Key words: strength, concrete, cement, numerically solving.

1 INTRODUCTION

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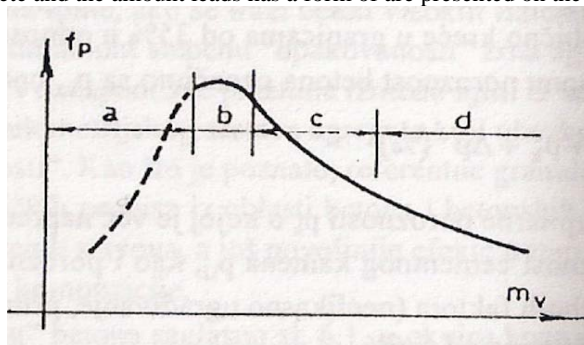


Figure 1.

Area blames „a“ has represented insufficiently are compacted the concrete whose consistency too stiff (the dry)-weak placeability.

Adding larger amount leads gets the more plastic concrete better placeability and by the fact itself and the larger strength of concrete - area blames „b“. Following increasing the amount water get more plastic (more fluent) mixtures which has the good placeability but the strength of concrete considerably declines - area blames the „c“. The in the end code very fluent mixtures of fresh concrete of strength yet reduces because of the appearance of segregation of concrete.

m_c – the amount of cement,

m_v – amounts water,

f_p – solidities of concretes by the pressure.

Typical guilty which expresses functional the connection of strength of concrete by the pressure and the water-cement value sees on the Figure 2.

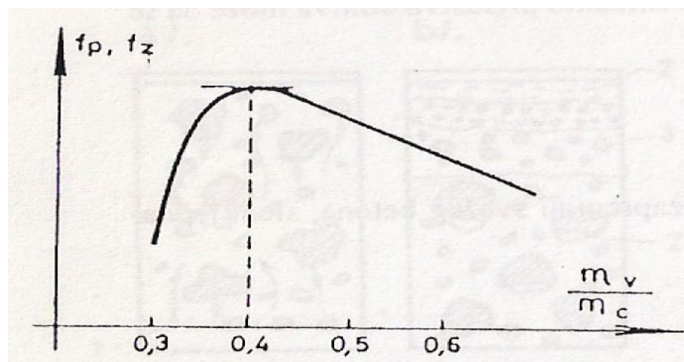


Figure 2. Dependence $m_v / m_c - f_p$

2. EXAMPLE

In this example is given analyses of terms of strength of concrete by the pressure and the water-cement value based on experimental testing of single samples and databases of the collected in the factory of concrete.

Data from the database have been classified in the dependence of the amount of cement in five groups (200,250,300,350,400 the kg). Are chosen amount of cement are most frequently are applied the amount of cement in the practical implementation.

Data have been classified so that first element represents amount water, second amount of cements and third laboratory obtained brands (the strength) the concrete on the pressure.

Datasheet

{0,200,0}, {30,200,1.1}, {120,200,9.2}, {180,200,12.5}, {400,200,0.0},
 {0,250,0}, {30,250,1.5}, {120,250,17.3}, {180,250,23.6}, {400,250,0.0},
 {0,300,0}, {30,300,2.3}, {120,300,24.8}, {180,300,33.9}, {400,300,0.0},
 {0,350,0}, {30,350,8.3}, {120,350,31.8}, {180,350,38.8}, {400,350,0.0},
 {0,400,0}, {30,400,10.4}, {120,400,36.3}, {180,400,42.1}, {400,400,0.0}.

First step in the establishing of functional dependences represents the need for the interpolation of input data.

Because of amplitudes of supplements for the illustration are chosen the data group with the amount of cement of 200 the kg.

Exists more different manners of interpolation of datasheet or determining interpolations functions.

In this example of interpolations of complete datasheet for all values of cement (200,250,300,350,400 the kg) has been carried out interpolation the polynomial.

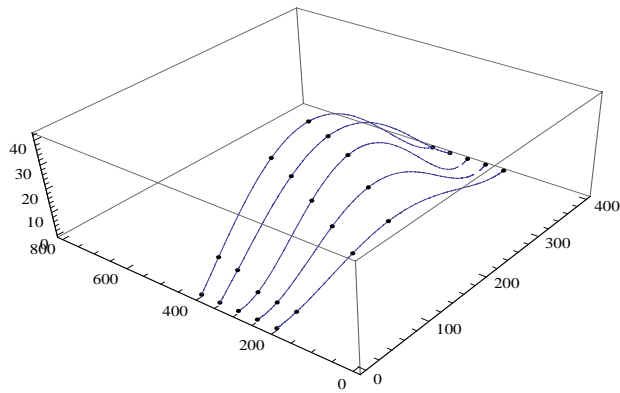


Figure 3. Are interpolated datasheet interpolation the polynomial

The up-to-date development of task have got are limited possibilities for the amount of cement has confiscated necessarily will execute and the interpolation of data in the backflow direction for selected values of amount water {0,30,120,180,400} liters.

Establishing the relationship between like this obtained the function and performing the interpolation of wheelbarrows between them using the interpolating polynomial able execute reading off the MB. (concrete strengths)-strength of concrete on the pressure in the any dot is got straight, Figure 4.

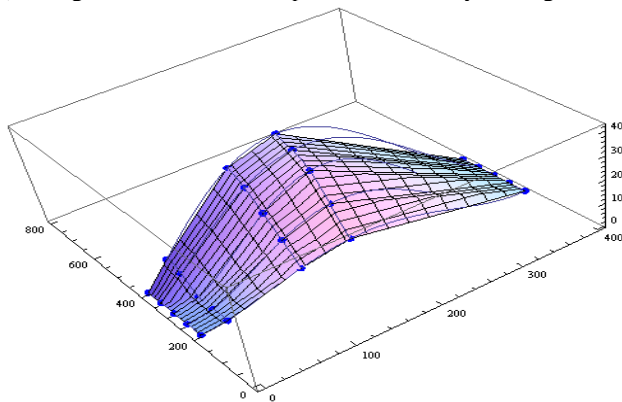


Figure 4. Space display

Illustrations of obtained of solution will be are presented on the following example:

INPUT DATA:
 CEMENT=270 to the kg
 WATER=150 of liters
 AMOUNT of CEMENT = 270 kilogram
 AMOUNTS WATER = 150 liters
 CONCRETE STRENGTH = 25.5554 the MPa

For required incoming results get the automatic reading off firmness-concrete strengths.
 For required input data of cement and the line form interpolations functions with the joint cutting dot.
 That dot in fact represents the strength-concrete strength.
 Are requested functions can present and in relation to the dot and functions from the datasheet.
 In the dependence of elections of manners of interpolation of incoming datasheet or determining interpolations functions can obtain designees of errors-deviations.
 That case it is possible notice and on the next display where has read off the difference between the interpolation of wheelbarrows interpolation the polynomial and spline the interpolation.

For the same datasheet interpolated linear spline get result which partially is different from up shown.

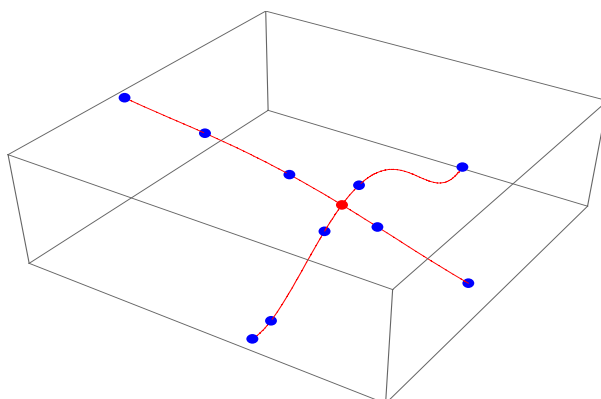


Figure 5. Functions of terms water, cement and concrete strengths

3. CONCLUSION

In contemporary the building practice prepares the concrete very significantly achieve answering the quality of hardened concrete, how from reasons of securities of structure and achievings appropriate project of required characteristics, so and from the business justification and uses currently available resources (the cement,water,agregat) and their correlation.

From these reasons intrudes the by itself need what for simpler and the faster analysis of entry parameters in order to are satisfied are requested conditions.

Through the use of the software solution done in the softwarskom package „the MATHEMATICA 6“ considerably increases the quality and the possibility what the more correct envisaging of characteristics of hardened concrete for the any relationship of input data – the water-cement value.

Through this example has been presented implementations of mathematical methods of interpolation on the solving of particular problems from the practice.

4. REFERENCES

- [1] D. Kidner, M. Dorey and D. Smith, Interpolation and extrapolation with a regular grid DEM. IV International Conference on GeoComputation, Fredericksburg, VA, USA, 1999.
- [2] D. Kincaid and W. Cheney, *Numerical Analysis (3rd edition)*, Brooks/Cole, 2002.
- [3] M. Schatzman, *Numerical Analysis, Mathematical Introduction*, Clarendon Press, Oxford, 2002.
- [4] Gary D. Knott, *Interpolating Cubic Splines*, Birkhäuser Boston; 1 edition, 1999.
- [5] George M. Philips, *Interpolation and Approximation by Polynomials*, Springer; 1 edition, 2003.
- [6] K. Atkinson, *An Introduction to Numerical Analysis*, New York, John Wiley & Sons, 1989.
- [7] F. Cellier and E. Kofman, *Continuous System Simulation*, Springer Verlag, 2006.
- [8] H. William, P. Brian and V. William, *Numerical Recipes: The Art of Scientific Computing (3rd ed.)*, Cambridge University Press, 2007.