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Math 1920  
Spring 1920

Exercises in Algebra

1920

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The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is equivalent to finding the minimum of a certain functional. This functional is defined as follows:

$$J(u) = \int_{\Omega} |\nabla u|^2 dx + \int_{\Omega} f(x) u dx$$

where  $\Omega$  is a bounded domain in  $\mathbb{R}^n$  and  $f(x)$  is a given function. The minimum of  $J(u)$  is attained at a function  $u$  which satisfies the boundary value problem

$$\Delta u + f(x) u = 0 \text{ in } \Omega, \quad u = 0 \text{ on } \partial\Omega$$

The second part of the paper is devoted to the construction of a numerical algorithm for the solution of this problem. It is shown that the problem can be solved by the method of steepest descent. The algorithm is as follows:

1. Choose an initial function  $u_0$ .
2. Compute the gradient of  $J(u)$  at  $u_0$ .
3. Move in the direction of the negative gradient to find a new function  $u_1$ .
4. Repeat steps 2 and 3 until convergence is achieved.

The third part of the paper is devoted to the analysis of the convergence of the algorithm. It is shown that the algorithm converges to the minimum of  $J(u)$  if the Hessian of  $J(u)$  is positive definite. This condition is satisfied if  $f(x) > 0$  in  $\Omega$ .

The fourth part of the paper is devoted to the numerical solution of the problem. It is shown that the algorithm converges rapidly to the minimum of  $J(u)$  for a wide class of functions  $f(x)$ .

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Ευθύων Τεττράων

Ζωήτωνων

Αθήναις

ε. 9 Οκτωβρίου 1919

Επιβίωση Τεχνητών

Αποστολών

Πηγή

in a book by the author

Ἑθινόν Πέμπτον

« Σύντομον »

Ἀντιγραφή  
τῆς 9 Σεπτεμβρίου 1961

Α. Α. Κ.