Chapitre 10 : Résumé

Introduction à l'analyse numérique

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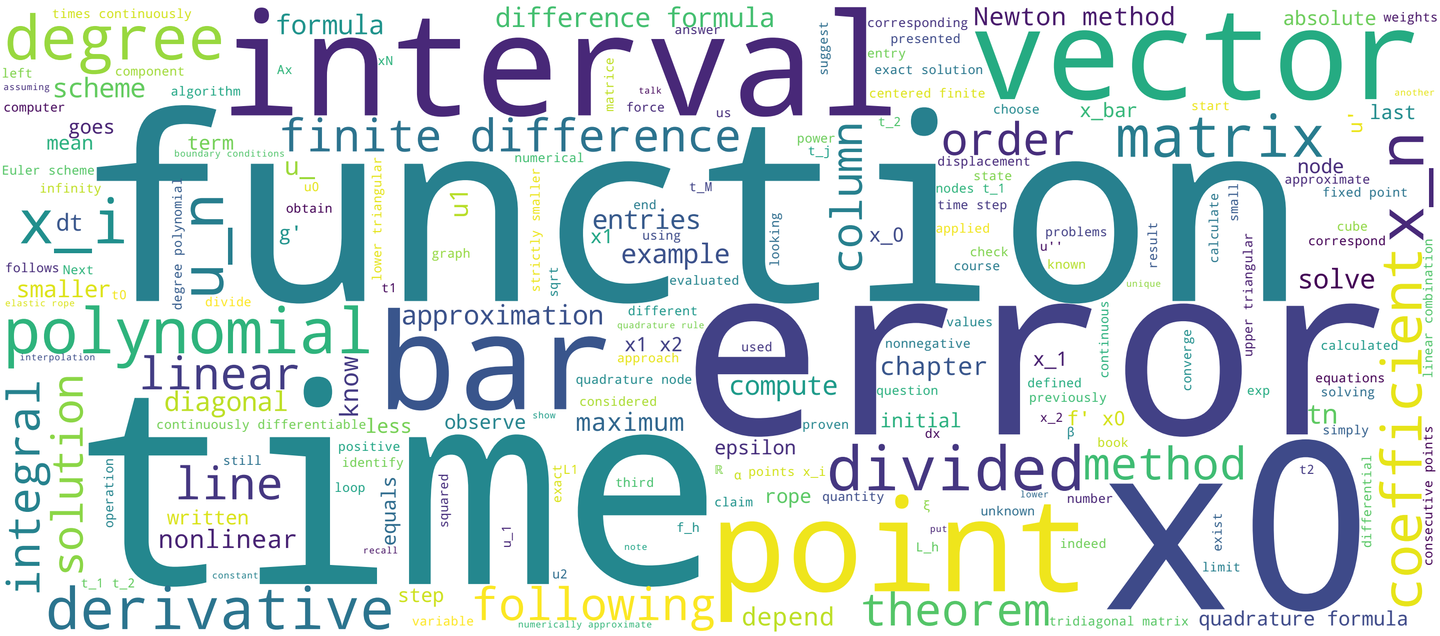
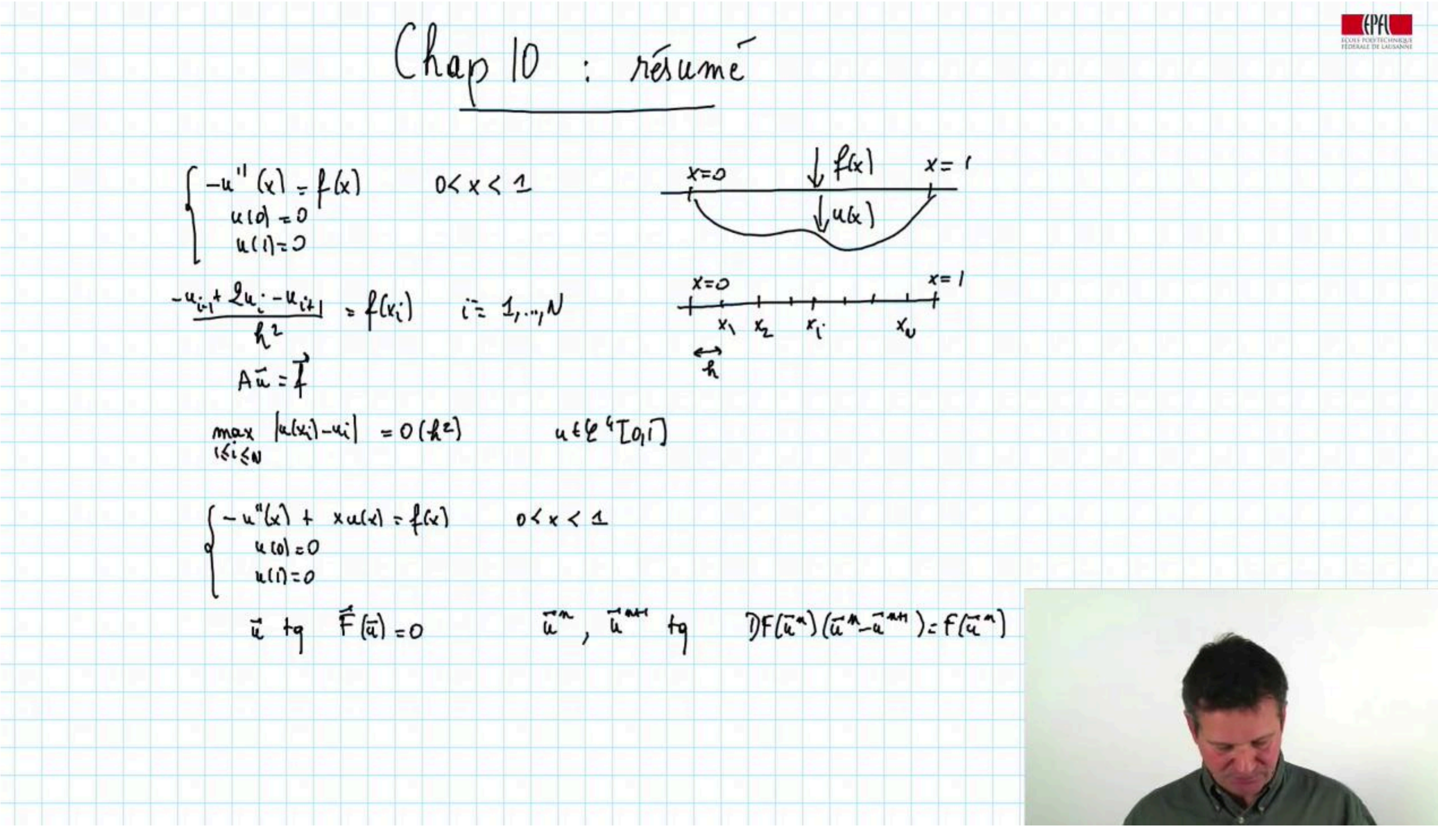


Video

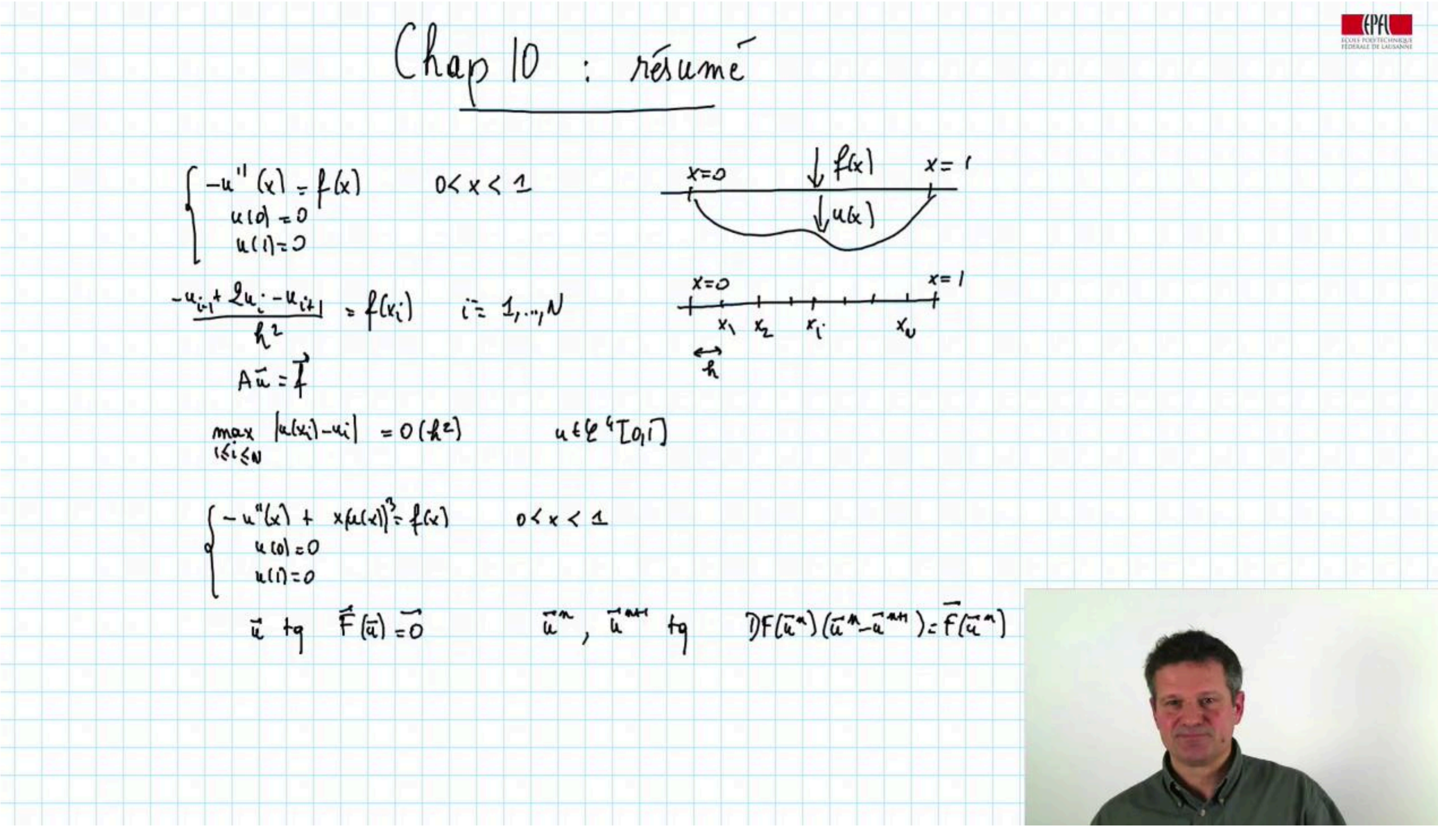


Now a quick summary of chapter 10. One dimension boundary value problems with the finite difference method. I considered the problem of the elastic rope - u"(x) = f(x), where f is given force, and u is the displacement of the rope, this for x in the interval [0,1]. The boundary conditions are u (0) = 0 and u(1) = 0. The rope is clamped at both ends. I presented a finite difference scheme, which was obtained using a centered finite difference formula of the second derivative. The scheme can be written: (-u_i-1 +2u_i - u_i+1) / h^2 = f(x_i), for all points x_i uniformly distributed on the rope. Here h is the step size which separates two consecutive points. I write the scheme as a linear system, A u = f, with A the tridiagonal matrix with 2 on the diagonal and -1 above and below the diagonal, with a coefficient 1/h^2 in front of this tridiagonal matrix. We have proven that the error is O(h^2), the maximum of the error between u(x_i), which is the unknown exact solution, and its approximation u_i which can be calculated by computer, this error is in O(h^2), this means that it is divided by 4 each time h is divided by 2, assuming that the solution u is four times continuously differentiable.

Notes

Summary

0m 04s



I then applied the same method to a nonlinear problem a nonlinear toy problem: -u"(x) +x u(x)^3 = f(x). *u(x)* au cube ici, donc *xu(x)* au cube, et j'ai appliqué la même méthode. Instead of obtaining a linear system A u = f, I have a nonlinear system: F(u) = 0 with F and u both vectors. We used Newton's method to approximate the solution to this problem, and this method was written as: u_n known, I will calculate u_n+1, which is such that Df(u_n) multiplied by u_n minus u_n+1 equal to F(u_n). I did not say it, but thus method is also O(h^2). I suggest to perform numerical experiments during the exercice session.

Notes

Summary

1m 32s