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NUMERICAL METHODS ARE TECHNIQUES TO APPROXIMATE MATHEMATICAL PROCESSES THIS INTRODUCTORY NUMERICAL METHODS COURSE WILL DEVELOP AND APPLY NUMERICAL TECHNIQUES FOR THE FOLLOWING MATHEMATICAL PROCESSES 1 ROOTS OF NONLINEAR EQUATIONS 2 SIMULTANEOUS LINEAR EQUATIONS 3 CURVE FITTING VIA INTERPOLATION 4 DIFFERENTIATION 5 CURVE FITTING VIA THIS COURSE OFFERS AN ADVANCED INTRODUCTION TO NUMERICAL ANALYSIS WITH A FOCUS ON ACCURACY AND EFFICIENCY OF NUMERICAL ALGORITHMS TOPICS INCLUDE SPARSE MATRIX ITERATIVE AND DENSE MATRIX ALGORITHMS IN NUMERICAL LINEAR ALGEBRA FOR LINEAR SYSTEMS AND EIGENPROBLEMS FLOATING POINT ARITHMETIC BACKWARDS ERROR ANALYSIS SHOW MORE NUMERICAL METHOD IN NUMERICAL ANALYSIS A NUMERICAL METHOD IS A MATHEMATICAL TOOL DESIGNED TO SOLVE NUMERICAL PROBLEMS THE IMPLEMENTATION OF A NUMERICAL METHOD WITH AN APPROPRIATE CONVERGENCE CHECK IN A PROGRAMMING LANGUAGE IS CALLED A NUMERICAL ALGORITHM LECTURE 1 COURSE OVERVIEW NEWTON S METHOD FOR ROOT FINDING SUMMARY BRIEF OVERVIEW OF THE HUGE FIELD OF NUMERICAL METHODS AND OUTLINE OF THE SMALL PORTION THAT THIS COURSE WILL COVER NUMERICAL ANALYSIS IS THE STUDY OF ALGORITHMS THAT USE NUMERICAL APPROXIMATION AS OPPOSED TO SYMBOLIC MANIPULATIONS FOR THE PROBLEMS OF MATHEMATICAL ANALYSIS AS DISTINGUISHED FROM DISCRETE MATHEMATICS IT IS THE STUDY OF NUMERICAL METHODS THAT ATTEMPT TO FIND APPROXIMATE SOLUTIONS OF PROBLEMS RATHER THAN THE EXACT ONES NUMERICAL METHODS FOR THE PHYSICAL SCIENCES AND ENGINEERING IT PROVIDES ACCESSIBLE SELF CONTAINED EXPLANATIONS OF MATHEMATICAL PRINCIPLES AVOIDING INTIMIDATING FORMAL PROOFS WORKED EXAMPLES AND TARGETED EXERCISES ENABLE THE STUDENT TO MASTER THE REALITIES OF USING NUMERICAL TECHNIQUES FOR COMMON NEEDS SUCH AS THE SOLUTION OF PYTHON PROGRAMMING AND NUMERICAL METHODS A GUIDE FOR ENGINEERS AND SCIENTISTS THIS NOTEBOOK CONTAINS AN EXCERPT FROM THE PYTHON PROGRAMMING AND NUMERICAL METHODS A GUIDE FOR ENGINEERS AND SCIENTISTS THE CONTENT IS ALSO AVAILABLE AT BERKELEY PYTHON NUMERICAL METHODS WE WILL THEN LEARN SOME FUNDAMENTAL NUMERICAL METHODS AND THEIR ASSOCIATED MATLAB FUNCTIONS THE NUMERICAL METHODS INCLUDED ARE THOSE USED FOR ROOT FINDING INTEGRATION SOLVING DIFFERENTIAL EQUATIONS SOLVING SYSTEMS OF EQUATIONS FINITE DIFFERENCE METHODS AND INTERPOLATION THIS COURSE ANALYZED THE BASIC TECHNIQUES FOR THE EFFICIENT NUMERICAL SOLUTION OF PROBLEMS IN SCIENCE AND ENGINEERING TOPICS SPANNED ROOT FINDING INTERPOLATION APPROXIMATION OF FUNCTIONS INTEGRATION DIFFERENTIAL EQUATIONS DIRECT AND ITERATIVE METHODS IN LINEAR ALGEBRA WELCOME TO THE NUMERICAL METHODS COURSE PLAYLIST IN THIS COMPREHENSIVE SERIES WE EXPLORE THE POWERFUL REALM OF NUMERICAL METHODS PROVIDING YOU WITH A SO THE GRID POINTS ARE OF AN EXAMPLE FOR AN EQUISPACED AND NON EQUISPACED NUMERICAL METHOD 10 4 10 3 10 2 10 1 100 10 14 10 12 10 10 10 8 10 6 10 4 10 2 100 FIGURE 3 CONVERGENCE OF THE NUMERICAL SOLUTIONS TO THE TRUE SOLUTION OF THE IVP GIVEN IN EQUATION 7 AT T 1 AS STEP SIZE H IS RE NED SHOWN IS THE SOLUTION GIVEN BY EULER S METHOD BLUE LANGUAGE ENGLISH FORMATS AVAILABLE PDF HARDCOPY CONDITIONS OF USE ATTRIBUTION CC BY TABLE OF CONTENTS REVIEW OF SOME BASIC MATHEMATICAL CONCEPT A CRASH COURSE IN PDE S FINITE DIFFERENCE METHODS FINITE VOLUME METHODS MINIMIZATION PROBLEMS IN PHYSICS THE NUMERICAL SOLUTION OF MINIMIZATION PROBLEMS NUMERICAL METHODS THE METHODS ARE ALSO CALLED ALGORITHMS AND ARE LIKE RECIPES ONE OF THE FAMOUS ALGORITHMS IS NEWTON S METHOD IT IS VERY USEFUL FOR FINDING ROOTS WHERE A FUNCTION CROSSES THE AXIS WE START WITH A GUESS X0 THEN FIND WHERE THAT PUTS US ON THE CURVE USING THAT POINT X0 F X0 AND IT S SLOPE WE FIND A NEW POINT ON THE THE MAIN TOPIC OF THE BOOK ENTAILS THE DESCRIPTION OF CLASSICAL NUMERICAL METHODS THAT ARE USED TO APPROXIMATE THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS THE FOCUS IS ON DISCRETIZATION METHODS SUCH AS THE FINITE DIFFERENCE FINITE VOLUME AND FINITE ELEMENT METHOD ABSTRACT THIS NEW BOOK FROM THE AUTHORS OF THE CLASSIC BOOK NUMERICAL METHODS ADDRESSES THE INCREASINGLY IMPORTANT ROLE OF NUMERICAL METHODS IN SCIENCE AND ENGINEERING MORE COHESIVE AND COMPREHENSIVE THAN ANY OTHER MODERN TEXTBOOK IN THE FIELD IT COMBINES TRADITIONAL AND WELL DEVELOPED TOPICS WITH OTHER MATERIAL THAT IS RARELY FOUND IN DESCRIPTION THIS NEW BOOK FROM THE AUTHORS OF THE HIGHLY SUCCESSFUL CLASSIC NUMERICAL METHODS PRENTICE HALL 1974 ADDRESSES THE INCREASINGLY IMPORTANT ROLE OF NUMERICAL METHODS IN SCIENCE AND ENGINEERING IT IS MORE COHESIVE AND COMPREHENSIVE THAN ANY OTHER MODERN TEXTBOOK IN THE FIELD NUMERICAL METHODS FOR ENGINEERS COURSE BY THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY COURSERA THIS COURSE IS PART OF MATHEMATICS FOR ENGINEERS SPECIALIZATION TAUGHT IN ENGLISH 22 LANGUAGES AVAILABLE SOME CONTENT MAY NOT BE TRANSLATED INSTRUCTOR JEFFREY R CHASNOV TOP INSTRUCTOR ENROLL FOR FREE STARTS MAY 13 THE INTERPOLATION

PROBLEM IS GIVEN A SET OF PAIRS OF VALUES X I Y I FOR I IN 0 N 1 FIND A FUNCTION P X WITHIN A PARTICULAR CLASS USUALLY POLYNOMIALS SUCH THAT P X I Y I IN THIS SECTION WE WILL ONLY CONSIDER POLYNOMIAL INTERPOLATION BUT OTHER SORTS OF FUNCTIONS CAN BE VERY USEFUL AS WELL SUCH AS RATIONAL OR TRIGONOMETRIC FUNCTIONS WE WILL START WITH EULER S METHOD THIS IS THE SIMPLEST NUMERICAL METHOD AKIN TO APPROXIMATING INTEGRALS USING RECTANGLES BUT IT CONTAINS THE BASIC IDEA COMMON TO ALL THE NUMERICAL METHODS WE WILL LOOK AT WE WILL ALSO DISCUSS MORE SOPHISTICATED METHODS THAT GIVE BETTER APPROXIMATIONS NUMERICAL ANALYSIS IS THE BRANCH OF MATHEMATICS THAT PROVIDES TOOLS AND METHODS FOR SOLVING MATHEMATICAL PROBLEMS IN NUMERICAL FORM IN NUMERICAL ANALYSIS WE ARE MAINLY INTERESTED IN IMPLEMENTATION AND ANALYSIS OF NUMERICAL ALGORITHMS FOR FINDING AN APPROXIMATE SOLUTION TO A MATHEMATICAL PROBLEM

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WE WILL THEN LEARN SOME FUNDAMENTAL NUMERICAL METHODS AND THEIR ASSOCIATED MATLAB FUNCTIONS THE NUMERICAL METHODS INCLUDED ARE THOSE USED FOR ROOT FINDING INTEGRATION SOLVING DIFFERENTIAL EQUATIONS SOLVING SYSTEMS OF EQUATIONS FINITE DIFFERENCE METHODS AND INTERPOLATION

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THIS COURSE ANALYZED THE BASIC TECHNIQUES FOR THE EFFICIENT NUMERICAL SOLUTION OF PROBLEMS IN SCIENCE AND ENGINEERING TOPICS SPANNED ROOT FINDING INTERPOLATION APPROXIMATION OF FUNCTIONS INTEGRATION DIFFERENTIAL EQUATIONS DIRECT AND ITERATIVE METHODS IN LINEAR ALGEBRA

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NUMERICAL METHODS THE METHODS ARE ALSO CALLED ALGORITHMS AND ARE LIKE RECIPES ONE OF THE FAMOUS ALGORITHMS IS NEWTON S METHOD IT IS VERY USEFUL FOR FINDING ROOTS WHERE A FUNCTION CROSSES THE AXIS WE START WITH A GUESS X0 THEN FIND WHERE THAT PUTS US ON THE CURVE USING THAT POINT X0 F X0 AND IT S SLOPE WE FIND A NEW POINT ON THE

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THE INTERPOLATION PROBLEM IS GIVEN A SET OF PAIRS OF VALUES x_i y_i FOR I IN 0 n 1 FIND A FUNCTION P X WITHIN A PARTICULAR CLASS USUALLY POLYNOMIALS SUCH THAT P x_i y_i IN THIS SECTION WE WILL ONLY CONSIDER POLYNOMIAL INTERPOLATION BUT OTHER SORTS OF FUNCTIONS CAN BE VERY USEFUL AS WELL SUCH AS RATIONAL OR TRIGONOMETRIC FUNCTIONS

NUMERICAL METHODS DIFFERENTIAL EQUATIONS MATHEMATICS

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WE WILL START WITH EULER S METHOD THIS IS THE SIMPLEST NUMERICAL METHOD AKIN TO APPROXIMATING INTEGRALS USING RECTANGLES BUT IT CONTAINS THE BASIC IDEA COMMON TO ALL THE NUMERICAL METHODS WE WILL LOOK AT WE WILL ALSO DISCUSS MORE SOPHISTICATED METHODS THAT GIVE BETTER APPROXIMATIONS

NOTES FOR NUMERICAL METHODS MATHCITY ORG

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