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Enhancing Accessibility of Laplace Transform for Introductory Mathematics Education

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Abstract

Through the use of simplification technique, this initiative aims to increase the accessibility of Laplace transform in the development of basic mathematics. This study explores the range of strategic meant to simplify complicated concept for learners. The commitment to improving Laplace transform accessibility is emphasized in the abstract, with the ultimate objectives being the development of a more productive and inclusive learning.

Keywords*:* Enhancing Accessibility, Laplace transform, introductory mathematics education.

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Introduction

The introduction of this study addresses the crucial task of enhancing the accessibility of Laplace Transforms (abbreviated as LT) in introductory mathematics education. Although Laplace transform are effective tool, students may find them challenging due to their complexity. In order to address this, this research focuses on applying on applying various simplification techniques to make these ideas more comprehensible. The study recognises that there is a need to close the understanding gap between students understanding of Laplace transform and the complexity of the topic in the introductory mathematics. The goal of this research is to make learning easier for students by investigating and using simplification technique which will help them to understand these basic ideas more fully. The study emphasizes how crucial it is to create an inclusive and learning environment since it takes into account different learning techniques and background of pupils. The primary motivation to enhancing teaching technique is to establish is to more functional and welcoming environment for teaching of beginning mathematics. This introduction provides a framework for a method of simplification used and how they can improve a wide range of student’s comprehension of Laplace transform (LT). The basic differential equation (D.E.) is first transformed into a general algebraic equation in the Laplace transform because algebraic equations are very simple to evaluate. Once these algebraic equations (AE) have been evaluated we use the inverse Laplace transform to transform them back into a LT. The LT, which describes the dynamical system, is obviously an algebraic form of the provided fundamental differential equation (DE) Ogata K., *et al.*, 2010, is introduced in many textbooks on linear circuit analysis (LCA) Carlson and Carlson 2000 and control systems Dorf *et al.*, 2011. The LT gives an equation y(s) which can be given in LT tables. The function y(s) must be divided into partial fractions in order to calculate the time-response function (TRF) y (t).The method of Partial fraction is another difficult and time-consuming technique that needs to be expatriation in order to match an entry in LT tables. It's quite interesting to note that, as Thomas *et al.*, 2015 shows, many indefinite integrals may be computed with the same technique by using tables of indefinite integrals that can be found in calculus textbooks. The rather archaic logarithm tables from secondary school mathematics are comparable to Laplace transforms in that they both involve finding the value (the antilogarithm) that corresponds to the sum of the logarithm that was obtained by converting a product of numbers Berezovski 2006.

Scope of the work: The project's purpose is to make Laplace Transforms more accessible to students learning introductory mathematics. Developing simplification tactics, clear explanations, and visual aids are all necessary to improve understanding of difficult Laplace Transform principles. The purpose of adopting interactive tools is to promote student engagement while also humanizing the subject matter. Different learning styles and talents are handled with a focus on diversity. The initiative's goal is to improve understanding of Laplace Transforms by shortening the learning process, allowing a wider audience to enjoy and comprehend fundamental mathematical concepts during their foundational education.

Literature Review

There is currently a dearth of study material on the Laplace transform. On the other hand four sources that are pertinent to our research were introduced to us. According to all of these sources, students struggled with the Laplace transform. The author contend in her PhD thesis Carstensen 2013 that although though many students find the Laplace Transform to be challenging concept to learn, the introduction to the Laplace transform is a critical component of instructional strategy that student employ. After discussing potential difficulties in teaching and understanding Laplace transforms, the research's authors Carstensen and Bernhard 2004 showed that this one is the one of the most difficult method for electrical engineering students to understand when studying electric circuit theory (ECT). They had seen that transitory response is tough because of the very complex mathematics being applied. The authors spoke with 22 university professors about the difficulties involved in learning and the application of the Laplace transform in engineering education. They observed that there was no resemblance among the teachers about the significance of the LT or the difficulties arrived in learning. Despite the fact that most teaching research focuses on giving the concepts to students and misconceptions of the subject, the paper highlights the importance of investigating teachers' understanding of the LT

Methodology: We think that there are two reasons why engineering students find it difficulty in learning the L.T. in regular classroom: Teaching students how to perform repetitive computing tasks in the same manner as a machine, such as manually calculating the inverse LT of an expression in order to enter data into a LT table. Like several learners, who find it challenging to evaluate a normal integral manually they see this as just one more tedious mechanical task that needs to be learned. Beginning with the traditional mathematical definition of the L.T. that is provided in textbooks, many engineering students may find this approach to be confusing since it detracts from their understanding of the concept and loses sight of its purpose Abou *et al.,* 2022. Furthermore, it is often the case that formal representations, real-world applications, and concepts are not connected in traditional instruction Thornton, 1997. The significance of the L.T. approach should also be evaluated, since it is susceptible to instructions that can handle much more complex D.E. (Differential equations). We are enquiring the usefulness of the L.T. Approach in engineering education given the availability of robust time-domain techniques for evaluating fixed types of differential equations, aside from the usage of CAS. However the authors do not wish to minimize the significance of the L.T. theory in various subjects such as mathematics, physics, or engineering. Conversely, researchers, investigators and scientists use the L.T. As one of their tools to tackle problems. In fact, the study's authors Reddy *et al.,* 2017 looked at 25 research papers from various academic disciplines and discussed how to use the L.T. to solve various investigating ideas. .

Conclusion

The study of domains in engineering education has to be revaluated, taking into consideration the outdated nature of conventional methods and acknowledging new methods as elements of updated praxeologies for these fields. The difference between a method and conceptual techniques in mathematics is not new, particularly when it arrives to algebra. For example, teachers in India wanted a knowledgeable presentation of algebra that would promote fundamental knowledge as early as 1890, protesting against what they perceived to be an overemphasis on manipulating abilities Rachlin 2018. Hence, when mathematical concept such as the L.T theory is being used in engineering science courses Bergsten *et al.,* 2016 said that a fundamental technique in mathematics is more significant than a wide explanation. For instance Flegg *et al.,* 2012 makes the case in which the importance of mathematical thinking in engineering processes may be lost if engineering mathematics is reduced to procedural and algorithmic knowledge. Due to this, practicing engineers today need to have a wider range of mathematical capabilities, including conceptual knowledge, rather than focusing just on procedural abilities, thanks to the advent of computing technology. Concept-based training can help improve conceptual understanding without compromising procedural abilities in undergraduate engineering mathematics instruction.

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