



Vedic Mathematics: Exploring Ancient Vedic Mathematics Principles and Their Modern Applications

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Abstract

Vedic Mathematics, derived from the ancient Indian scriptures known as the Vedas, encompasses a distinct system of mathematical computation and reasoning. This study article investigates the concepts of Vedic Mathematics, including its historical relevance and theoretical foundations. The research investigates the present applications of these historical methodologies in education and computing disciplines. By examining the efficiency and variety of Vedic approaches, this research hopes to emphasize their potential for improving mathematics understanding and problem-solving skills.

Keywords: Vedic Mathematics, Sutras, Computational Efficiency, Educational Techniques, Ancient Mathematics, Modern Applications

1. Introduction

Vedic Mathematics, a fascinating topic based on the ancient Indian writings known as the Vedas, is a complicated set of mathematical concepts and procedures. The Vedas, which date from approximately 1500-900 BCE, are a vast corpus of knowledge that comprises the Rigveda, Yajurveda, Samaveda, and Atharvaveda. These texts contain a comprehensive mathematical framework that offers alternatives to traditional arithmetic, algebra, and geometry. This foundation, known as Vedic Mathematics, was meticulously documented and preserved for centuries, primarily through oral tradition before being put into written form. Sri Bharati Krsna Tirthaji (1884-1960) found an ancient mathematical theory from the Vedas between 1911 and 1918, known as Vedic Mathematics. Students can develop their ways that are not limited to a single correct method. It produces more creative, engaged, and intelligent



students. (Dhivyadeepa, E. and Singaravelu, Govindarajan., 2013). The originator of Vedic mathematics claims that it was taught to the current by traditional sages from Asian countries, although there is no historical proof to support this claim. In this survey paper, we will create a reader. Vedic mathematics, as well as some forward-thinking space projects. (Raksha and Shetty, Shravan and Kumar, Shravan and M. Monisha, 2022). It is quite tough to excite children in a school subject such as mathematics. Teachers spend a lot of time attempting to find something that will pique kids' interest. The experimental group's results are expected to improve following short lectures on Vedic mathematics, and students will become more interested in mathematics. (Resic, Sead; Lemo, Adin., 2015).

Vedic Mathematics is notable for its simplicity, speed, and reliance on mental computation. Unlike standard mathematical approaches, which usually rely on step-by-step procedures and extensive writing, Vedic techniques promote intuitive thinking and mental agility. This makes the Vedic technique exceptionally successful for tackling complex mathematical problems with little effort. The sutras, or aphorisms, are the basis of Vedic mathematics. These simple and powerful formulas encapsulate vast mathematical principles, allowing practitioners to perform quick calculations and deduce results by mental computation. Vedic mathematics has gained popularity over the last decade due to its ancient but effective arithmetic and algebra approaches. It sheds light on the broader ramifications of combining old mathematical knowledge with modern cryptographic techniques, paving the path for novel approaches to digital communication security and data privacy. (Kumar, C R Suthikshn. 2024).

Vedic Mathematics can be traced back to the Sulbasutras, which are ancient books that contain geometric principles for building altars and other sacred structures. These writings show a comprehensive understanding of mathematical ideas like the Pythagorean theorem, which was established long before it was taught in the Western world. The Vedic approach to mathematics was comprehensive, combining numerical calculations with philosophical and spiritual insights to demonstrate the interconnectedness of knowledge in Vedic culture. Studies have examined 16 Vedic Mathematics Sutras that can be used to boost multiplier



speed while decreasing its area and delay. (S. Shembalkar, S. Dhole, T. Yadav, and P. Thakre, 2017).

Vedic mathematics is still important today, beyond historical curiosity. Its principles are being rediscovered and applied in a variety of contemporary contexts, particularly in education and computers. The system's emphasis on mental calculation and pattern detection is a welcome departure from standard mathematics teaching, which typically fails to engage students and alleviate arithmetic dread. Using Vedic approaches, educators can help students enhance their numerical skills and get a better understanding of mathematical concepts.

The computational efficiency of Vedic algorithms has significant promise in the realm of computer science. Modern applications such as cryptography, data encryption, and error detection can all benefit from Vedic approaches to improve procedures and efficiency. Vedic Mathematics' versatility and adaptability make it an invaluable resource for developing novel solutions to today's computational challenges.

This paper seeks to investigate the core concepts of Vedic Mathematics, including its historical context and theoretical foundation. It looks into the relevance and application of these old methodologies in modern educational and computational procedures. This study aims to demonstrate Vedic Mathematics' long-term significance and capacity to improve our understanding and approach to mathematical problem-solving by bridging the gap between ancient wisdom and modern requirements.

Most digital signal processing (DSP) applications rely heavily on multiplication and accumulation. Real-time signal processing necessitates a fast and high-throughput Multiplier-Accumulator (MAC) unit that uses little power, which is always essential for establishing a high-performance digital signal processing system. The coding is done in VHDL, while the synthesis is done using the Xilinx ISE series. The post-synthesis combinational delay is compared to the performance of Ramesh Pushpangadam's "Modified Booth Wallace Multiplier" and "High-speed Vedic multiplier." Our proposed Vedic multiplier appears to offer superior performance. (Jaina D., Sethi K., & Panda R., 2011).

2. Theoretical Framework



The theoretical foundation of Vedic Mathematics is comprised of sixteen core sutras (aphorisms) and thirteen sub-sutras (corollaries), which together encompass a wide range of mathematical operations. The sutras in question provide a comprehensive and very efficient approach to tackling a range of mathematical problems, making the system both powerful and adaptable. The sutras are concise and easy to remember and can be utilized to perform quick mental calculations, simplifying computing operations and developing a deeper understanding of mathematical concepts. Vedic Mathematics, a collection of mental calculating techniques inherited from ancient Indian scriptures, provides simple and effective solutions for a wide range of mathematical operations. By precisely defining and proving these Vedic Theorems, this work not only preserves Vedic Mathematics' rich past, but also makes it more accessible and relevant to modern mathematicians, educators, and students. (Kumar, CRS, 2024). Vedic mathematics refers to the ancient Indian mathematical system that was rediscovered in the early twentieth century through ancient Indian sculptures (Vedas). The design implementation on the ALTERA Cyclone II FPGA demonstrates that the suggested Vedic multiplier and square are quicker than the array multiplication and Booth multiplier. (Tiwari, Honey, and Gankhuyag; Ganzorig & Kim; Chan & Cho, Yong., 2008).

2.1 The key principles of Vedic Mathematics include:

2.1.1 Ekadhikena Purvena (By One More Than the Previous One): This sutra is primarily used for finding the squares of numbers ending in 5. For instance, to square the number 25, one can use the formula $((n+1) \times n)$ where (n) is the number formed by dropping the last digit (5 in this case). Thus, $(2 \times 3 = 6)$, and appending 25 to this result gives 625.

2.1.2 Nikhilam Navatashcaramam Dashatah (All from 9 and the Last from 10): This principle simplifies subtraction and aids in multiplication, especially with numbers close to powers of 10. For example, to multiply 97 by 98, one can subtract each number from 100, yielding 3 and 2, respectively.



Subtract the cross sum from 100 ($100 - (3+2) = 95$), and then multiply the differences ($3 \times 2 = 6$), resulting in 9506.

2.1.3 Urdhva-Tiryagbhyam (Vertically and Crosswise): This versatile technique applies to multiplication and factorization, enabling quick calculations. For example, to multiply 23 by 12, one multiply crosswise and vertically: $((2 \times 1) + (3 \times 2) = 2 + 6 = 8)$ and $((2 \times 2) + (3 \times 1) = 4 + 3 = 7)$, resulting in 276.

3. Modern Applications: Vedic Mathematics concepts, which are rooted in ancient Indian wisdom, have found application in some modern situations, demonstrating their adaptability and efficiency. The application of these theories extends to educational techniques, computing efficiency, and cognitive development, demonstrating their potential to address present difficulties in these fields. Edge detection, clustering, and region growth are the standard segmentation methods discussed here. The order of multiplication will increase in complexity. When compared to other multipliers, it requires less space. (Lakshmi, K., Kishore, D., and Kumar, Sanjeev, 2022). The multiplier is the primary building block of all processors, and it increases the speed of the Digital Signal Processor (DSP). We must lessen the time delay. Our proposed multiplication algorithm has a lower time delay than other techniques. (Kahar, D. K. and Mehta, H., 2017).

3.1 Educational Techniques: Vedic Mathematics is gradually being implemented into educational programs around the world to help pupils improve their arithmetic skills and overcome math phobia. Traditional teaching techniques frequently rely on procedural learning, which can result in a superficial comprehension of mathematical topics and a lack of interest. Vedic mathematics stresses mental calculation, pattern recognition, and logical reasoning, offering a more intuitive and holistic approach to mathematical education.

The introduction of Vedic techniques into the curriculum enables pupils to address difficulties creatively and adaptable. For example, using sutras like "Urdhva-Tiryagbhyam" (Vertically and Crosswise) for multiplication allows students to



conduct calculations mentally, which fosters a deeper grasp of number connections and improves numerical fluency. These strategies can be very useful in lowering math anxiety, which is a major impediment to successful learning. Vedic Mathematics boosts students' self-esteem and enthusiasm for the subject by allowing them to solve problems swiftly and confidently.

Vedic Mathematics-based educational programs frequently indicate gains in students' problem-solving abilities and general arithmetic performance. The emphasis on mental agility and logical reasoning not only improves mathematical aptitude but also fosters important cognitive skills that may be applied across other disciplines.

3.2 Computational Efficiency: In the field of computer science, algorithms drawn from Vedic sutras are used to create effective computational procedures. These algorithms, known for their simplicity and efficiency, can optimize operations in a variety of domains, including cryptography, data encryption, and error detection and repair.

Vedic multiplication techniques can be used to create quicker multiplication algorithms for digital signal processing and other computer tasks that need rapid arithmetic operations. These algorithms' efficiency stems from their capacity to reduce the number of computing steps, resulting in faster processing and less resource use.

Vedic algorithms can help improve the security and efficiency of encryption procedures. Complex encryption keys can be generated and manipulated more easily and quickly using methods like "Nikhilam Navatashcaramam Dashatah" (All from 9 and the Last from 10), which improves the overall robustness of cryptographic systems.

Vedic concepts can also be used to improve error detection and correction algorithms. The ability to do fast and accurate calculations provides data integrity, which is critical in communication systems, storage, and transmission.



3.3 Cognitive Development: According to research, learning Vedic mathematics can considerably improve cognitive processes like memory, attention, and spatial reasoning. These cognitive advantages make Vedic Mathematics an important instrument in cognitive training and rehabilitation programs.

The mental exercises required for Vedic mathematics activate diverse brain regions, increasing neural connection and cognitive flexibility. For example, using sutras for mental arithmetic necessitates sustained attention and working memory, both of which are essential components of cognitive functioning. Regular application of these strategies can result in improvements in these areas, as indicated by improved performance in memory retention, focus, and problem-solving activities.

Early Childhood Care and Education (ECCE) is not a new subject or a new approach for India. (Raval, A., 2022). In ECCE Vedic Mathematics will help a child to gain interest and understanding in Mathematics which leads to developing the logical ability of the child. Vedic Mathematics can be used effectively in cognitive rehabilitation programs for those with cognitive disabilities or neurological diseases. Therapists can assist patients in improving their cognitive capacities and speed up their rehabilitation by engaging them in systematic mental exercises based on Vedic concepts. Vedic approaches are versatile and adaptable, making them suited for a wide range of cognitive training applications, including improving academic achievement in youngsters and assisting in the rehabilitation of people with cognitive deficiencies. Modern uses of Vedic Mathematics are broad, providing considerable benefits in education, computing efficiency, and cognitive development. The ancient concepts incorporated in the Vedas are still relevant and useful in tackling contemporary difficulties, demonstrating the continuing significance of this great mathematical system.

4. Conclusion

The study of Vedic Mathematics indicates its immense influence on both ancient and modern mathematical practices. These mathematical approaches, based on old Vedic notions, provide



unique solutions to difficult problems, underscoring their significance. By merging these time-honored approaches into modern educational and computational domains, we provide new opportunities for efficiency, increased knowledge, and cognitive development. Incorporating Vedic Mathematics into modern schools enhances learning experiences by strengthening intuitive problem-solving skills and increasing computational capacity. Its application in computer disciplines such as cryptography, data encryption, and error correction algorithms proves its versatility and usefulness in today's digital world.

Continued research and practical implementation will shed more light on Vedic Mathematics' vast potential and applications. As scientists and educators delve deeper into its principles and methodologies, we get insights that not only improve mathematics education but also contribute to advancements in a range of scientific and technological sectors. Vedic Mathematics exhibits the timeless wisdom contained in ancient Indian literature. Its application in the current educational curriculum and computing frameworks is not only commendable.

References:

- Bharati Krishna Tirthaji Maharaja. (1965). Vedic Mathematics. Motilal Banarsidass Publishers.
- Dhivyadeepa, E & Singaravelu, Govindarajan. (2013). A Theoretical View on Vedic Mathematics.
- Jaina, D., Sethi, K., & Panda, R. (2011, October). Vedic mathematics based multiply accumulate unit. In 2011 International Conference on Computational Intelligence and Communication Networks (pp. 754-757). IEEE.
- Kahar, D. K., & Mehta, H. (2017, June). High-speed Vedic multiplier used Vedic mathematics. In 2017 International Conference on Intelligent Computing and Control Systems (ICICCS) (pp. 356-359). IEEE.
- Kumar, C R Suthikshn. (2024). Applications of Vedic Mathematics to Cryptography. 10.31224/3583.
- Kumar, CRS. (2024). Vedic Theorems based on Vedic Mathematics Sutras. 10.31224/3744.



Lakshmi, K. & Kishore, D. & Kumar, Sanjeev. (2022). Analysis of Multiplication Based on Vedic Mathematics. 10.3233/ATDE220804.

Raksha, & Shetty, Shravan & Kumar, Shravan & M, Monisha. (2022). Review on Vedic Mathematics. International Journal of Advanced Research in Science, Communication and Technology. 342-347. 10.48175/IJARSCT-3127.

Raval, A. (2022). બાળ ઉછેર અને કેળવણી (ECCE) માં વાત્ત. Towards Excellence, 14(4).

Retrieved from <https://hrdc.gujaratuniversity.ac.in/Publication/article?id=12300>

Resic, Sead & Lemo, Adin. (2015). VEDIC MATHEMATICS. Journal Human Research in Rehabilitation. 5. 23-30. 10.21554/hrr.091509.

Shembalkar, S., Dhole, S., Yadav, T., & Thakre, P. (2017). Vedic Mathematics Sutras-A Review. ratio, 4(12y), 3.

Tirtha, S. B. K., & Agrawala, V. S. (1992). Vedic mathematics (Vol. 10). Motilal Banarsidass Publ.

Tiwari, Honey & Gankhuyag, Ganzorig & Kim, Chan & Cho, Yong. (2008). Multiplier design based on ancient Indian Vedic Mathematics. 2. II-65. 10.1109/SOCDC.2008.4815685.

Williams, K. R. (2005). Discover Vedic Mathematics: Easy Techniques for Speedy Calculations. Orient Paperbacks.