Abstract

The Strong Goldbach's conjecture also known as the Binary Goldbach conjecture (BGC) is one of the oldest and best-known unsolved problems in Number theory and all of mathematics. It states that every even integer greater than 2 can be expressed as the sum of two primes. A Goldbach number is a positive even integer that can be expressed as the sum of two odd primes. Since 4 is the only number greater than 2 that requires the even prime 2 to be written as the sum of two primes, another form of the statement of the Strong Goldbach's Conjecture is that all even integers greater than 4 are Goldbach numbers. The BGC has set a persistent challenge to the exploration of the foundations of mathematics in general and Number theory in particular as it remains unproven for foundations of mathematics in general and Number Theory in particular as it remains unproven for almost 250 years despite considerable efforts by mathematicians throughout history. The best known result so far is that of Chen proving that every sufficiently large even integer N can be written as the sum of a prime and the product of at most two prime numbers. The known algorithms for attempting to prove or verify the BGC on a given interval [a, b] consist of finding two sets of primes Pi and Pj such that Pi + Pj cover all the even numbers in the interval [a, b]. The traditional representation of an even number is 2k for $k \in N$ and this formulation has not provided mathematicians with a direct pathway to easily obtain all Goldbach partitions for any even number of this form. This study introduces a new formulation of a set of even numbers as an integer E of the form Eij = ni+nj=(nj-ni) n for all $n \in N$. The proof that this new formulation holds $\forall n < \infty$ is provided. This new definition will have two consequences: (1) using the new formulation of a set of even numbers, it has proved that any even number say E_{ij} can be partioned into all pairs of all odd numbers whose sum is Eij, and (2) from these set of pairs of odd numbers, it has been shown that there exists at least one Goldbach partition for Eij. Finally, a rigorous proof of the Strong Goldbach's conjecture is provided. The study further recommends the exploration of the method of partitioning any even number into all pairs of odd numbers so as to find a new method of attacks to the Twin Prime Conjecture and the Weak Goldbach Conjecture.