**In 1991 Fermat’s Last Theorem Has Been Proved (I)**

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**Abstract:** In 1637 Fermat wrote: “*It is impossible to separate a cube into two cubes, or a biquadrate into two biquadrates, or in general any power higher than the second into powers of like degree: I have discovered a truly marvelous proof, which this margin is too small to contain.*” This means:  has no integer solutions, all different from 0 (i.e., it has only the trivial solution, where one of the integers is equal to 0). It has been called Fermat’s last theorem (FLT). It suffices to prove FLT for exponent 4. and every prime exponent . Fermat proved FLT for exponent 4. Euler proved FLT for exponent 3.On October 25,1991 we proved Fermat last theorem.

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**Keywords:** 1991; Fermat’s Last Theorem;prime exponent 

In this paper using the complex hyperbolic functions we prove FLT for exponents  and , where  is an odd prime. The proof of FLT must be direct. But indirect proof of FLT is disbelieving.

In 1974 Jiang found out Euler formula of the cyclotomic real numbers in the cyclotomic fields

 (1)

where  denotes a th root of unity, ,  is an odd number,  are the real numbers.

 is called th complex hyperbolic functions of order  with  variables [1-7].

 (2)

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where *i*=1,2,…,*n*;

, ,

,  (3)

(2) may be written in the matrix form

  (4)

where  is an even number.

From (4) we have its inverse transformation

  (5)

From (5) we have

, 

, (6)

In (3) and (6)  and  have the same formulas. (4) and (5) are the most critical formulas of proofs for FLT. Using (4) and (5) in 1991 Jiang invented that every factor of exponent  has the Fermat equation and proved FLT [1-7] Substituting (4) into (5) we prove (5).







, （7）

where , .

From (3) we have

. （8）

From (6) we have

, （9）

where [7].

From (8) and (9) we have the circulant determinant

 （10）

If , where , then (10) has infinitely many rational solutions.

Assume , ,  where  are  indeterminate equations with  variables. From (6) we have

, . （11）

From (10) and (11) we have the Fermat equation

 （12）

**Example**[1]. Let . From (3) we have





,



,



,



,



,



,



,

. (13)

Form (12) we have the Fermat equation

. (14)

From (13) we have

. （15)

From (11) we have

. (16)

From (15) and (16) we have the Fermat equation

. （17)

Euler proved that (14) has no rational solutions for exponent 3[8]. Therefore we prove that (17) has no rational solutions for exponent 5[1].

**Theorem 1.** [1-7]. Let ,where  is odd prime. From (12) we have the Fermat’s equation

. (18)

From (3) we have

. (19)

From (11) we have

. (20)

From (19) and (20) we have the Fermat equation

. （21)

Euler proved that (18) has no rational solutions for exponent 3[8]. Therefore we prove that (21) has no rational solutions for  [1, 3-7].

Note. Wiles had not proved Fermat last theorem[9-11]

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