Optimal Choice of Wind Turbines Combination Based on Customer's Requirements

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Abstract – **This paper presents a reliability-based approach to select appropriate wind turbines combination based on customer's requirements. We present the algorithm for generating integer partitions in the standard representation.**

Keywords – **Wind turbine, wind farm, partition theory, Ferrers diagram, partition generating.**

I. INTRODUCTION

Energy producing on the wind turbine unit depends on the wind speed [1]. Thus, wind turbines are working on stochastic graphic and consumer's requires a energy supply according to given chart.

Typically, a wind farm consist of a few dozen to several hundred individual wind turbines with different technical characteristics. Selecting a set of wind turbines relies on operator. But due to lack of time, this choice is often unjustified.

II. ANALYSIS OF PARTITION METHODS

In number theory, a partition of a positive integer *N* as a sum of positive integers. Two sums that differ only in the order of their summands are considered to be the same partitions; if order matter then the sum becomes a composition [2].

$$N = x_1 + x_2 + ... + x_k \text{, where } x_i > 0, i = 1,...,k \quad (1)$$

A number of all composition of $N \geq 1$ *is:*

$$\sum_{k=1}^{N} C_{N-1}^{k-1} = 2^{N-1} \quad (2)$$

So there are 2^{N-1} composition of $N \geq 1$.

A partition of a positive integer *N* is a finite no increasing sequence of positive integer $x_1, x_2, ..., x_k$. The x_i called the parts of the partition.

The partition function $p(N)$ represents the number of possible partitions of a natural number *N*, which is to say the number of distinct (and order independent) ways of representing *N* as a sum of natural numbers. The number of possible partitions of a natural number *N* on *k* parts named as $p_k(N)$. Clearly, the correct the next rule:

$$p(N) = \sum_{k=1}^{N} p_k(N) \quad (3)$$

Some values of the partition function are given in Table 1.

TABLE 1

VALUES OF $p(N)$ AND $p_k(N)$

k \ N	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1
2	0	1	1	2	2	3	3	4	4	5
3	0	0	1	1	2	3	4	5	7	8
4	0	0	0	1	1	2	3	5	6	9
5	0	0	0	0	1	1	2	3	5	7
6	0	0	0	0	0	1	1	2	3	5
7	0	0	0	0	0	0	1	1	2	3
8	0	0	0	0	0	0	0	1	1	2
9	0	0	0	0	0	0	0	0	1	1
10	0	0	0	0	0	0	0	0	0	1
$p(N)$	1	2	3	5	7	11	15	22	30	42

Another effective elementary device for studying partitions is the graphical representation. To each partition x_i is associated its graphical representation, which formally is the set of points with integral coordinates (*i,j*). By turning the rows into columns, we obtain the another partition. Such partitions are said to be conjugate of one another [3].

III. THE METHOD FOR GENERATING INTEGER PARTITIONS

The first step is the summation and comparison of all parts *k* with *N* in the range $0 \geq k \geq N$. For example, if *N=3* and *k=2* then the first record will be $k_1 = 3; k_2 = 3$. Also in the first iteration we must to determine all possible values of wind turbine power. As a result we get an array of combinations.

After these we should to sum all items in all records and compare with the number *N*.

Next step is to sorting all items in records in ascending order and rejecting identical records leaving only one.

Last step is to comparing founded combination with available wind turbine power.

IV. CONCLUSION

The method determines the necessary set of wind turbines for electricity supply customers.

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