satellites for 1×10^6 times. The simulation result can be seen in Fig. 4 and TABLE Ⅱ.

Analysing the statistical data in TABLE Ⅱ, it's undeniable that the satellite selection result of ASMS is not the optimal. However there will be about ten million random combinations of different 8 satellites (C_{35}^{8}). It is impossible to traverse all the combinations and find the one which minimize the GDOP value for its huge amount of calculation and time-consuming (tens of minutes for once). ASMS can finish the calculation process within less than 100 milliseconds. Under the premise of sacrificing the GDOP value a little, it reduces the computation and improves the satellite selection speed.

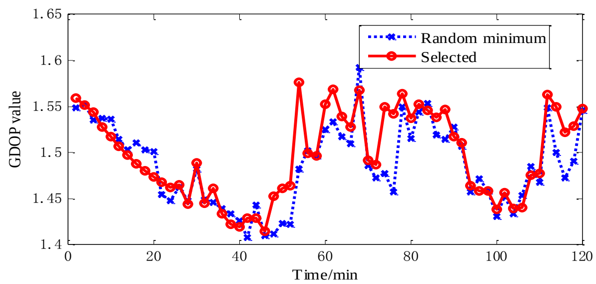

Fig. 4 GDOP value for selected 8 satellites and random 8 satellites in the first simulation experiment

TABLE Ⅱ The statistical data of the first experiment

The GDOP value	Mean	Variance	Standard deviation
Selected 8satellites	1.4973	0.0022	0.0467
Random 8 satellites	1.4780	0.0020	0.0443

In the second experiment, ASMS is used to respectively select 10, 14, 18 and 22 satellites from GPS and Galileo. The simulation result is shown in Fig. 5.

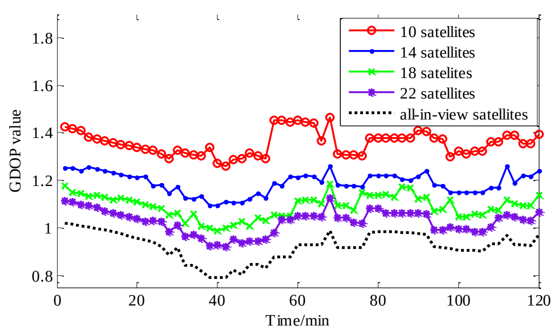

Fig. 5 GDOP value for different number of selected satellites

As seen in Fig. 5, with the increasing of the number of satellites selected by ASMS, the GDOP value decreases. The GDOP value is close to that of all-in-view satellites with the increasing of selected satellites number.

It can be confirmed from above two experiments that although the satellite selection may not be the optimal, compared with traversing all of satellites combinations, ASMS greatly reduces computation. Moreover, with the increasing of selected satellites number, the GDOP value decreases. Therefore it can be studied determining the number of selected satellites according to the receiver's needs of positioning accuracy.

V. Conclusions

Starting with derivation the relationship of the optimal SRG and the minimum GDOP value in 2-D, a rule to obtain the minimum GDOP value has been found, which is to make matrix G^TG a diagonal matrix. Through this rule, a formula (Formula (13)) that is used to calculate the minimum GDOP value of *n* satellites in 3-D was deduced and its reliability was verified by simulation. Meanwhile the optimal SRG to minimize the GDOP value in 3-D was summarized: for *n* satellites ($n\geq4$), there should be *m* at the zenith and *m-n* in the horizontal plane to constitute a regular polygon.

After analysing the minimum GDOP value and the optimal SRG of *n* satellites in 3-D, an algorithm of selecting more than 4 satellites from GNSS (ASMS) was proposed. ASMS can get the small GDOP value and improve satellite selection efficiency by selecting the satellites whose SRG is close to the optimal one. By two simulation experiments, the good performance of ASMS is illustrated.

Because the thresholds of elevation angle in Step 5 are to be determined, ASMS should be studied further.

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