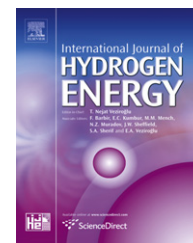


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Comment on: “Experimental and numerical investigation on solar concentrating characteristics of a sixteen dish concentrator”. By Xia et al., International Journal of Hydrogen Energy 2012; 37(24):18694–18703

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ABSTRACT

For the sake of discussion to concentrating characteristics of multi dish concentrator, a simple calculation method of layout is given. By comparative study, the key of designing identical multi dish solar concentrator is confocal is deduced. In confocal and suitable f/D ratio conditions the smaller receiving aperture could be ensured, and the compound paraboloid receiver is not necessary.

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1. Introduction

While parabolic dish have traditionally been used for high flux/high power solar concentration devices, the manufacture of multi dish concentrator has been complicated somewhat by the need to produce reflecting elements having different curvatures for different regions of the parabolic surface, they need to be relatively precise and the expensive to fabricate and to transport. However, this complication and expensive could be minimized by using identical spherical or parabolic reflector sub-components dish mounted with a parabolic orientation on a space frame dish structure [2,3].

The f/D ratio for these sub-components dish is much more than that for single-facet concentrator, therefore, one of the key technical issues of the multi dish facet approach will be

how well the multi dish can be formed to the required focus contour [1].

The reference about the layout calculation of multi dish concentrator is rarely. Literature mostly involves complicated calculation. Xia et al. [6] investigated the characteristic of identical sixteen dish concentrator in tandem with half ellipsoid and compound paraboloid receiver, and deduced that compound paraboloid receiver is superior to half ellipsoid receiver with identical sixteen dish concentrator. Based on the structure data in Xia's paper, the focus result is showed in Fig. 1. No confocal is obvious. Maybe the layout calculation of multi dish concentrator is too complicated.

In this comment, a simple calculation method of layout is given. Through an identical sixteen dish concentrator constructed as Xia's multi dish parameters, the focus performance is comparatively analyzed.

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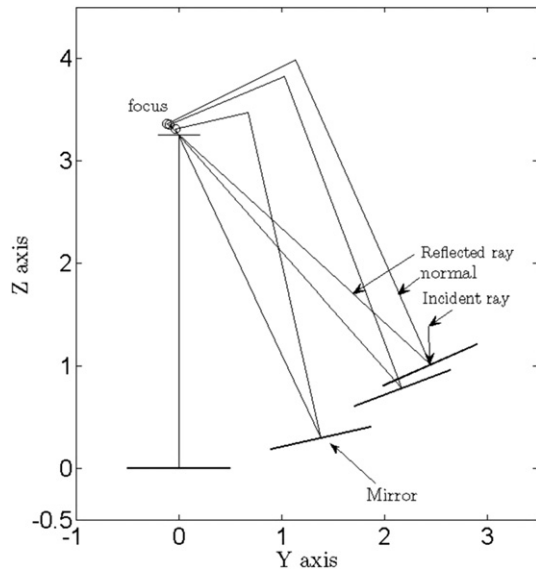


Fig. 1 – The focal schematic of Xia's by ray tracing.

2. Theory of layout calculation

The focus result of the identical thirteen multi dish mounted with a parabolic orientation on one dimension is shown in Fig. 2. Each dish is made of a spherical configuration with a focal length of 7.4 m, and the focal length of parabolic is 7.4 m. As shown in Fig. 2, thick solid line of arrow shape is focus point distribution of thirteen multi dish. Focus width and depth is 0.87 m and 0.45 m, respectively. The focus efficiency

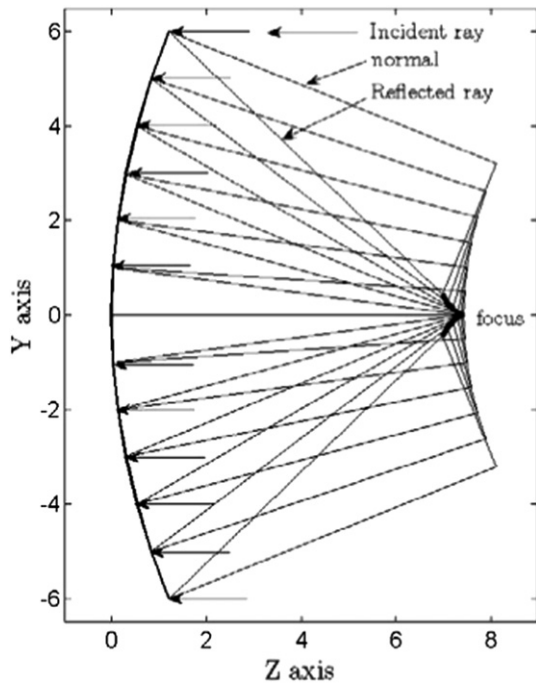


Fig. 2 – The schematic of ray tracing for identical multi dish mounted with a parabolic orientation.

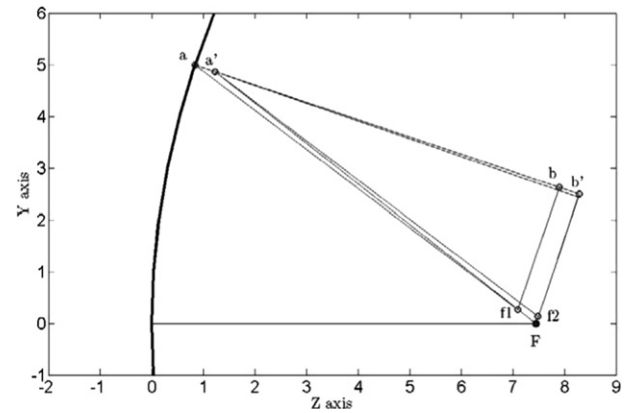


Fig. 3 – The geometry illustration of layout calculation.

is lower according to mount with a parabolic orientation using identical multi dish. This is the reason why a lot of built hundreds of square meters concentrators use small dish of multi group focus length approximating paraboloid [4,5].

As shown in Fig. 3, the geometry calculation of single dish focusing is given based on parabola. The thick solid line is parabolic basis in the left of Fig. 3. Presuming point a is the position of dish on parabolic basis, $aa'bb'$ line is normal, F is focus point of parabolic basis, point b is focus point of optic axis mounted on point a . Moving along normal of dish to point a' , b' is new focus point of optic axis. The moving length in normal must guarantee that $b'F$ line should lie in focal plane of new place. In parallel incident ray condition point $f1$ and $f2$ is focus of dish at point a and point a' , respectively. Because $f2$

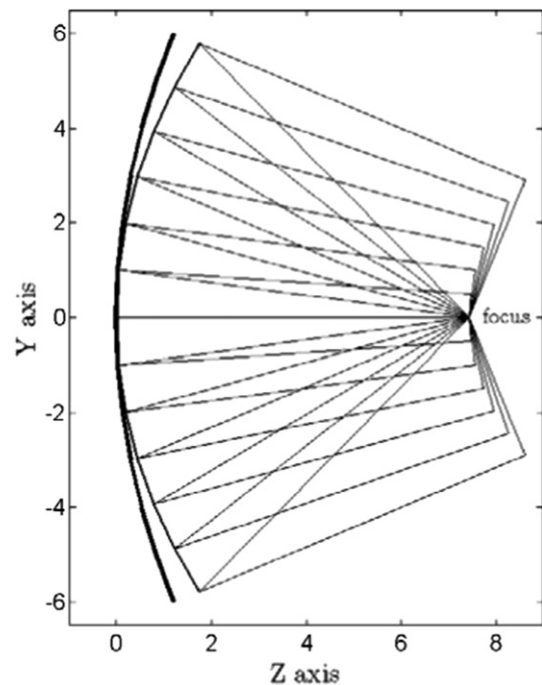


Fig. 4 – Ray tracing of confocal identical multi dish.

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