The Polar Equations of Water Distribution from Butterfly Sprinkler Heads

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This project aims to derive the polar equations from relation of the points on the center line of water that swirls from Butterfly sprinkler heads. The water path including the inner rim, the outer rim, and the center line in the middle of water path is generated by the Rhombus's property. We are interested in deriving the polar equations of the center lines of water that twist from 4 types of the Butterfly sprinkler heads; i.e., edge frame, curve frame, stainless (STL) frame, and stainless rotary (STL rotary) frame. Then, the polar equations of the outer rim and the inner rim can be derived by adding and removing the ratio of the distance between the outer rim and the center line to the geometric sequence from the polar equation, respectively. The results show that the water path and the blade get wider as the ratio value increases which causes the droplets of water to be distributed thoroughly. Besides, the relationship between the volume of water and the radius of water distribution can be used to find the least time it takes to give the appropriate moisture level to the soil. Furthermore, we study spiral in 3D that is similar to conical spiral. We have found that the polar equation can predict the radius of water distribution and simulate the movement of droplets that swirl from Butterfly sprinkler heads. Keywords: Polar equation, Sprinkler, Water path

Awards Won:
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