





etc. The radial distortion mainly includes barrel distortion and pincushion distortion.

In order to simulate the more vividly targeting distortion Need to use Bezier surfaces, The Bézier surface equation:

$$P(u,v) = \sum_{i=0}^m \sum_{j=0}^n P_{i,j} B_{i,m}(u) B_{j,n}(v) \quad u, v \in [0,1]$$

The values of  $P_{i,j}$  is a set of control points, At the same time ,The value of  $P_{i,j}$  can also be used to represent the vertices, normals, colors and texture coordinates.  $B_{i,m}(u)$  ,  $B_{j,n}(v)$  ,is m and n Bethesda Wilkie function Respectively.

#### IV. virtual target and test analysis

##### A targets Category

The target is generally divided into hard and soft, the hard such as metal, wood, etc., and soft, such as cloth, paper, etc..The deformation of a hard material target is relatively small by natural environment. However, it is difficult to stand target in windy weather. The deformation of a soft material target is relatively large by natural environment, but the soft materials has good air permeability, standing target convenience, it is suitable for the production of a large area of the field target.

##### B target image geometric distortion

Studying the image from geometric, the image is the projection images of the object in a projection plane. Therefore, even with a same target object, due to the projection plane and perspective the geometric shape of the image is different. In the process of the actual image acquisition, the phenomenon of the change of spatial relationship between the pixels in the image called the geometric distortion of the image.

Due to the relative positional relationship of the target and the camera , Lens distortion and camera quality, as well as the effect of the natural environment ,such as wind , rain, fog , snow, visibility, target acquisition, etc. The acquisition of target image exists geometric distortion.

##### C analog target test analysis

Since the acquisition target images from a different location, angle and distance, Dimensional dynamic target subscript simulation through the set target subject center position coordinates, the camera's X, Y, Z-coordinate, the camera moving, and the camera rotation angle, etc. parameters, which can simulate a camera in a different position and angle of the shooting of the target image .As shown in Figure 5:

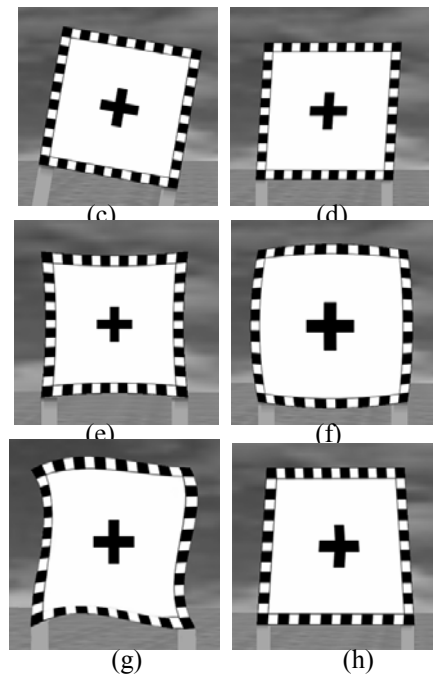
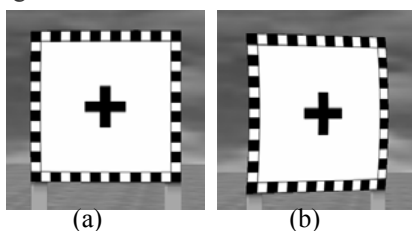


Figure 5 The image of target

In Figure 5, Figure (a) is Orthoscopic image captured when the camera vertical to the target, Figure (b) (c) is Hermitian transform, figure (d) for the affine transformation, which is due to certain displacement and rotation of the camera to the target, Figure (e) is a frame-shaped distortion, Figure (f) is a barrel distortion, Figure (g) is a distortion caused by camera imaging lens curvature uneven, Glass material texture inconsistent, Target surface is uneven, geometric distortion which caused by Natural environmental impact such as the wind and other reasons, Figure (h) is the projection transformation, the target distortion caused by the camera and the target do not maintain absolute vertical shooting at a certain inclination angle.

#### V. Conclusion

Through the simulation of real-time dynamic 3D Targets, which vividly simulate several common geometric distortion of a target, verify the feasibility of the design of the target, and provides a theoretical basis for making a real target.

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