



The velocity of a 3-D point in the probe coordinate is related to the probe spatial velocity using the well-known equation



Taking the constraints into considerations,



Manipulate these equations, we obtain the relationship between velocity of the tracking point in the probe coordinate and that of probe in matrix form.

is the interaction matrix.

Control law

We take image-based visual servo control (IBVS) to minimize an error .

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Where s consists of a set of features that are immediately available in the image data while s\* define the desired the desired values of the features.

where s contain one or more points marked in the image and these points can be stacked in one general form.

The tracking error and the derivative of the tracking error in the image plane must converge to zero. We use the differential equation to ensure an exponential decoupled decrease of the error as well as the time derivative of the error.

*ke*=0

We obtain

*e*