
# A Versatile Homography Computation Method Based on Two Real Points

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# A Versatile Homography Computation Method Based on Two Real Points

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**Abstract**

In this paper, we present a novel 2D homography computation method which could decompose one homography into three parts: first projective transformation, middle hyperbolic similarity transformation, and last projective transformation. The main advantage of our method is that we only use two general and real points to compute the first and the last projective transformations and other image primitives (could be point(s), line(s), conic and higher curve) to obtain the middle hyperbolic similarity transformation. Thus the proposed method has an important geometric interpretation and can deal with almost all 2D patterns especially when they are degenerate or composed of mixed primitives. The proposed method is firstly introduced to analyze a 2D pattern with a conic and a coplanar line. For this 7 degree-of-freedom pattern, the obtained homography will have one unknown rotation parameter in the generalized similarity transformation. Then, we demonstrate how the method deal with various 2D patterns and show the applications in metric rectification, camera calibration and pose estimation. One great merit is that all plane-based geometric problems can be formulated as polynomial systems in a unified way. The experiments with simulated and real data verify the correctness and the versatility of our algorithm.

*Keywords:* camera calibration, homography, circular points, pose estimation, hyperbolic rotation, rectangular hyperbolic points