Main progress of adaptively robust filter with applications in navigation

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Abstract: Recent years a new adaptively robust filtering with application in kinematic navigation and positioning has been systematically established and developed. The adaptively robust filter applies a robust estimation principle to resist the effects of measurement outliers and introduces an adaptive factor to control the influences of the kinematic model disturbances. The main achievements of the adaptively robust filter are summarized. It includes the principle of the adaptively robust filter with the corresponding state estimator, the four adaptive factors for balancing the contribution of kinematic model information and measurements, which include three-segment function, two-segment function, exponential function and zero and one function for state component adaptation; the four kinds of learning statistics for judging the kinematic model errors, which include state discrepancy statistic, predicted residual statistic, variance component ratio statistic and velocity discrepancy statistic. The relations of the adaptively robust filter with standard Kalman filter, robust filter, and some other adaptive Kalman filters as well as some related adjustment methods are depicted by a figure. Other developments and applications of the adaptively robust filter are also mentioned. Two examples are presented.