SC42050 Literature Assignment

Distributed Kalman Filtering

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Nowadays robots are more and more autonomous; one interesting problem for them is how to localize themselves based on their knowledge of the environment. One idea is to use a distributed version of the Kalman Filter. After reading (Olfati-Saber, 2005) answer the following questions:

1. Perform a short literature survey on distributed algorithms for sensing.
2. Why does the author use the Information Form of the Kalman Filter rather that the standard form (you may need extra literature)?
3. How do the results depend on the interconnection graph? For instance, node 25 and 100 seem to have a very good estimation of the moving object, but from Fig. 5, this is not true for all the nodes, why?
4. One way to improve the cohesion of the set of estimations in Fig. 5 is to design the sensor network in some optimal way. Suppose the moving object is fixed in space, try to formulate a meaningful optimization problem for the structure of the network; why is this problem hard to solve?
5. Another way to improve that cohesion is to allow agents to resend the information received, why is it useful? What are the drawbacks?
6. In your opinion, how asynchronism in the communication could affect the performances of the DKF?

References

Olfati-Saber, R. (2005). Distributed Kalman filter with embedded consensus filters. In *Proceeding of the IEEE Conference on Decision and Control*, pages 8179–8184.