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CTU Diploma Project Review  
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CTU Diploma Project review- 2<sup>nd</sup> reviewer's evaluation of master thesis with title  
"Multi-agent System Distributed Sensor Fusion Algorithms" by Space Master student Shaondip  
Bhattacharya.

I find that the goal of the thesis project well fulfills the requirements of a master thesis in space technology. The work concerns sensor fusion using a graph model and comparing different methods with variants including a novel state update algorithm.

Comparison simulations are performed using two input signals (a DC and a harmonic function of a given frequency) with additive Gaussian white noise and a model graph consisting of 6 nodes (sensing and no-sensing). The thesis includes a mathematical background part introducing relevant basic concepts to the reader and also the theoretical development of the novel algorithm.

The sensor responses are visualized in graphs and output variances for a given set of sensor initial states and input variances are calculated followed by a short qualitative comparison in terms of better or worse performance. It is not completely clear from the report, but I, as a reviewer has interpreted the discussion regarding simulation results as based on "one shot" (i.e not Monte Carlo). For the oral presentation it would be good to clarify this since it is of importance for the validity of the discussion regarding the results if it is based on single scenarios or not. Also a more extensive discussion regarding the results for the Luenberger observer should have been included.

The thesis also present coupling graphs for state covariance and cross correlation. This parts of the thesis I consider the weakest. The discussion on the results is qualitative, and it is very difficult for the reader to interpret the differences between the methods from the graphs and the following discussion. For example why is fig 4.24 symmetric and 4.23 non-symmetric. A phase lag is seen in this graph. Comments on this?

The output noise is also discussed. The author claims that since the input noise is Gaussian white noise with a Dirac auto-correlation function, the output shows filtered colored noise (filtered by the system). Even if the input noise at each sensor is one draft from such a process, the auto-correlation function for each draft will not be a Dirac function. The same holds for the output noise. In order to see whether the noise is colored or not you have to use many drafts to estimate the statistics.

From the thesis it is not clear whether the novel algorithm is given to the student or independently developed by him. Based on the review above I recommend to grade the thesis by C( good). If the student, during the oral presentation, shows that the novel algorithm proposal and mathematical analysis is his own independent work the grade should be increased.

This review serves solely for the purposes of the diploma project defense at CTU. LTU official evaluation for the SpaceMaster double degree will follow the thesis defense and may differ from this review report and suggested grade.

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