Particle Filtering of Two Targets That Maneuver In and Out a Formation Flight

IEEE/AES Seminar at Georgia Tech Research Institute (GTRI)
February 12, 2010

Henk A.P. Blom, PhD

National Aerospace Laboratory NLR
Amsterdam, The Netherlands
blom@nlr.nl

Abstract

In theory, a good particle filter allows to approximate an exact Bayesian filter solution arbitrarily well. This has motivated a strong and successful development of particle filtering approaches towards target tracking. In this presentation we pose the question whether this theory also applies to problems of tracking two targets that maneuver in and out a formation flight, and where the observations may include false measurements, missed detections and limited sensor resolution.

The specific aspects addressed in the presentation are:

- Mathematical formulation of the problem [1]-[2]

- Exact Bayesian recursion of the conditional joint density [1]-[2]

- IMMJPDA and IMMJPDA* filtering results [1]-[2]

- Particle Filtering results [2]-[5]

- Unique decomposition of the conditional joint density [6]

Emphasis of the presentation is on the insight gained. Background information and references to relevant other work is available in the references below.

References:

1. H.A.P. Blom, E.A. Bloem, Exact Bayesian filter and joint IMM coupled PDA tracking of maneuvering targets from possibly missing and false measurements, Automatica, Vol. 42 (2006), pp. 127-135.
2. H.A.P. Blom, E.A. Bloem, Joint particle filtering of multiple maneuvering targets from possibly unassociated measurements, Journal of Advances in Information Fusion, Vol. 1, Number 1, July 2006, pp. 15-34. Available at http://www.isif.org/
3. H.A.P. Blom, E.A. Bloem, Bayesian tracking of two possibly unresolved targets, IEEE Tr. Aerospace and Electronic Systems, Vol. 43 (2007), pp. 612-627.
4. H.A.P. Blom, E.A. Bloem, Hybrid SIR joint particle filter under limited sensor resolution, Proc. Int. Conf. on Information Fusion 2007, Quebec, Canada, 9-12th July 2007.

5. H.A.P. Blom, E.A. Bloem, Y. Boers and H. Driessen, Tracking closely spaced targets: Bayes outperformed by an approximation?, Proc. Int. Conf. on Information Fusion, Cologne, Germany, July 1-3, 2008.
6. H.A.P. Blom, E.A. Bloem, Permutation invariance in Bayesian estimation of two targets that maneuver in and out formation flight, Proc. 12th International Conference on Information Fusion, Seattle, WA, USA, July 6-9, 2009