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RANDOM MEDIA AND PROCESSES ESTIMATION USING FILTERING TECHNIQUES : APPLICATION TO ENSEMBLE WEATHER FORECAST AND AIRCRAFT TRAJECTORIES

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Résumé :

Aircraft trajectory prediction error can be explained by different factors. One of them is the weather forecast uncertainties. For example, the wind forecast error has a non negligible impact on the along track accuracy for the predicted aircraft position. From a different perspective, that means that aircrafts can be used as local sensors to estimate the weather forecast error.
In this work we describe the estimation problem as several acquisition processes of a same random field. When the field is homogeneous, we prove that they are equivalent to random processes evolving in a random media for which a Feynman-Kac formulation is done. Then we give a particle-based approximation and provide convergence results of the ensuing estimators.
When the random field is not homogeneous but can be decomposed in homogeneous sub-domains, a different model is proposed based on the coupling of different acquisition processes. From there, a Feynman-Kac formulation is derived and its particle-based approximation is suggested.
Furthermore, we develop an aircraft trajectory prediction model. Finally we demonstrate on a simulation set-up that our algorithms can estimate the wind forecast errors using the aircraft observations delivered along their trajectory.

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