[2008-1026] Design of an Adaptive Particle Filter Based on Variance Reduction Technique

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摘要

The main problem of particle filter (PF) in nonlinear state estimation is the particle degeneracy. Resampling operation solves degeneracy to some extent, but it results in the problem of sample impoverishment. Variance reduction technique is proposed to deal with the degeneration phenomenon in this paper, which reduce the variance of the particle weights by selecting an exponential fading factor and this factor can be chosen adaptively and iteratively in terms of the effective particle number. A theorem is presented to show that this idea is feasible, and the procedure of this new adaptive particle filtering (APF) algorithm is presented. Then the principle of parameter choice and the limitation of APF are discussed. Finally, a numerical example illustrates that the proposed APF has a higher estimation precision than PF-SIR (Particle filter-sampling importance resampling), GPF (Genetic particle filter) and PSOPF (Particle swarm optimization particle filter), while the computation load of APF is mild.

关键词　particle filter　variance reduction　degeneracy　sample impoverishment

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