The stability problems of the least mean fourth (LMF) algorithm put a limitation on its tracking capability. The paper investigates the possibility of solving this problem via stabilization of the algorithm. The analysis is done for a Markov plant. It is found that the available stable normalized LMF (NLMF) algorithm has a tracking limitation for high signal-to-noise ratio. The paper presents a new stable NLMF algorithm that is free of this limitation. Mean-square stability of the algorithm is proved. Expressions are derived for the minimum steady-state mean square deviation (MSD) and the corresponding convergence time. The new algorithm outperforms the available stable NLMF algorithm in both the transient and steady states. The new algorithm is also compared with the NLMS algorithm when the adaptation parameter of each algorithm is set to the value that minimizes its steady-state MSD. For large initial MSD, the algorithm outperforms the NLMS algorithm, even for Gaussian noise. For small initial MSD, the algorithm outperforms the NLMS algorithm for sub-Gaussian noise, while the situation is opposite for Gaussian noise. Analytical results are supported by simulations.