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## Skew-symmetric representations of posterior densities

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The perturbation of symmetric densities via suitably designed skewing functions yields a broad and similarly tractable class of asymmetric extensions, known as skew-symmetric family. Although such a family has been mostly overlooked in Bayesian statistics, its potential impact could be substantial. As shown in this presentation, any generic posterior density can, in fact, be re-expressed in a skew-symmetric form by decomposing it as the product of (i) a symmetrized version of such a density and (ii) a tractable closed-form skewing function that only depends on the un-normalized posterior. This representation opens the avenues for the design of broadly applicable strategies perturbing, at no additional optimization cost, any symmetric posterior approximation (e.g., from the Laplace method, variational Bayes and expectation-propagation) to obtain similarly tractable skew-symmetric alternatives. This improved class of deterministic approximations provably enhances the finite sample accuracy of the original symmetric counterparts and, under suitable assumptions, it improves the convergence rate to the exact posterior by at least a  $\sqrt{n}$  factor, in asymptotic regimes.