The alpha effect of the geodynamo

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Applied mathematical investigations of dynamo action is not quite popular recently since most research efforts are directed toward numerical MHD dynamo simulations. However, importance of applied mathmatical research has been realized these days in order to understand the results of numerical simulations. In this talk, therefore, we will review applied mathematical studies on the alpha-effect of dynamo action, and introduce our recent research on non-local and non-instantaneous behaviour of the alpha-effect. We examine G.O. Roberts' simple helical flow with two-dimensional periodicity, and calculate the exact expression of the non-local and non-instantaneous alpha-effect. As a result, we find qualitative interpretation of non-local and non-instantaneous behaviours for the magnetic Reynolds number of order unity.