The derivative of a function of an operator and some applications

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ABSTRACT. First, for motivation, some problems in numerical analysis and statistical functional data analysis are described where differentiation of an analytic function of an operator would be a useful tool. Then some general theory for differentiation of such a function is presented, with application to expansions of eigenvalues, their multiplicities, and corresponding eigenprojections of perturbed operators. It is shown how this can be applied to yield the asymptotic distribution of analytic functions of the sample covariance operator, based on samples of functional data. Finally, the introductory examples are revisited in the light of the above mentioned theoretical results.