Some attempt in mathematical modelling of the IMAGE random field and its Loeve-Karhunen expansion eigenfunctions

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The first symple model considered is a direct product of two one dimensional markov processes; such 1-dimensional case has been studied in some detail by several authors in past years. The 1-D eigenfunctions are determined by the zeros of a trigonometric equation, but their symmetrized products doe not seem to resemble the real 2-d eigenfunctions; when it is realized that their reordering according to a little perturbation calculation provides an almost correct sequence of eigenvalues one realizes too that they map one to one with the experimentally obtained set of eigenfunctions in almost the same order and with the same symmetry properties, and moreover they are good approximations of the corresponding experimental eigenfunctions.

A second model considers the Covariance function to posses rotational invariance. It turns out that the Covariance function experimentally evaluated from data (a large and symmetry preserving collection of Image tessels) has just rotational symmetry with a relative error smaller than 0.2%. and can be easily fitted by means of exponential and polynomial functions. The solution of the Fredholm equation in not in general analytically possible, except for a "tessels" of circular shape (Telescopes for instance!) in which case the solution reduces to symple bessel functions while eigenvalues are particular values of the Haenkel transform of the power spectrum of the covariance function.

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