A Model Selection Strategy of Gaussian Process Regression for Modeling Inset-Fed Microstrip Patch Antenna

Karim FERROUDJI, Abdelmaled Reddaf, Islem BOUCHACHI, Boudjerda Mounir

Abstract: This paper presents a modeling of inset-fed microstrip patch antenna using Gaussian Process Regression (GPR) technique. The vast majority of the studies employ a readily existing model, using a fixed mean and covariance functions without further investigation. In this paper we propose a strategy to choose the most appropriate parameters of Gaussian process regression technique for modeling inset-fed microstrip patch antenna. We evaluate the influence of the choice of mean and covariance functions on the performance of the GPR models. Moreover, the dependency of the antenna resonant frequencies on the physical and geometrical properties of the materials involved, dimensions of the patch, and the feed location is investigated. In order to validate the performance of the proposed GPR model, we evaluate different algorithms with main focus on Radial Basis Function Neural Networks, and Multilayer Perceptron Neural Network. The obtained results show that the proposed method outperforms the neural network models in terms of mean square error and determination coefficient. The results give a good agreement with the results obtained using HFSS software, which ensures the validity of our proposed model in the evaluation of the resonant frequency over a spectrum range of 1-10 GHz.

Keywords: Gaussian Process Regression, model selection, Microstrip Patch Antenna, Resonant Frequency