ABSTRACT

Electronically steerable passive array radiator (ESPAR) antennas can be used in Beamspace (BS)-Multiple Input Multiple Output (MIMO) systems because of beamforming capabilities using a single RF-chain. The mutual coupling effect on each ESPAR antenna element affects the combination of reactance in the parasitic element to form a radiation pattern in a particular direction. An ESPAR antenna in the BS-MIMO system has the ability to combine a number of information symbols within the beamspace domain using an orthogonal basis pattern. Therefore, the radiation pattern in BS-MIMO is a representation of the information symbol in the combination of the basis pattern.

The number of basis patterns is determined by the dimension of the *aerial degrees of freedom* (ADoF) due to the influence of the antenna structure using a single RF-chain. The Gram-Schmidt method is used to generate an orthogonal basis pattern. However, the number of orthogonal basis patterns can be reduced due to channel conditions that have a lot of scattering. Therefore, it can affect the pattern of the radiation pattern that required by the system. The radiation pattern required by the BS-MIMO system is obtained through a linear combination of symbols against the number of available basis patterns. An ESPAR antenna needs to determine the value of reactance in each parasitic element in order to produce the radiation pattern required by the BS-MIMO system. This research analyzes the availability of the basis pattern due to the influence of the number of parasitic elements on the correlation of ESPAR antenna radiation pattern required by the BS-MIMO system with the radiation pattern generated from the reactance in each parasitic element.

The genetic algorithm (GA) is used to search the combination of reactance in each parasitic element to form the radiation pattern required by the BS-MIMO system. The radiation patterns reference can be generated from *channel-ignorant* and *channel-aware* conditions. Therefore, this research analyzes the correlation of radiation pattern produced by GA to radiation pattern required by BS-MIMO system on ESPAR antenna 5 elements and 7 elements in different channel conditions.

In *channel-ignorant* condition, correlation of radiation pattern on 7 elements ESPAR antenna has a median value of 99.46% and 5 elements of 98.43%. While the maximum value of ESPAR antenna with 7 elemens is 99.94% and ESPAR antenna with 5 elements is 99.78%. In *channel-aware* conditions, ESPAR antenna with 7 elements has a median value of 90.58% and ESPAR antenna with 5 elements is 89.85%. While the maximum value of ESPAR 7 element antenna is 93,40% and ESPAR antenna 5 elements equal to 92,32%. Therefore, in both *channel-ignorant* and *channel-aware* conditions ESPAR antenna 7 elements have a higher correlation seen from median value and maximum value.

Keywords : Multiple Input Multiple Output (MIMO), Beamspace, Electronically Steerable Passive Array Radiator (ESPAR) Antenna, Genetic Algorithm (GA), Aerial Degrees of Freedom (ADoF).