# Investigation of Analytical Solution for Radiated Fields of Slot Yagi-Uda Array through Mutual Coupling Analysis

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The Yagi-Uda antenna array is one of the oldest directive antenna designs. the main advantage of a Yagi-Uda design is the achievement of a directive radiation pattern through parasitic coupling to nearby passive elements. Classic Yagi-Uda antennas are dipole arrays with lengths and spacings designed using well-established tables that allow a design to electrically scale the array to a desired operating frequency. Other elements besides dipoles can also be used to create a directive Yagi-Uda array; however the design process for an array with other elements is not well established. Yagi-Uda antenna arrays are typically designed using the dipole tables and then tuned using a full wave computational electromagnetic solver to achieve the desired performance. A closed-form analytical solution to the design of a Yagi-Uda antenna array could eliminate much of this guess-and-check process while also providing a deeper understanding to the structure. Previous work has analyzed the Yagi-Uda array performance through mutual impedance - but that was limited to dipole antennas.

A closed-form analytical solution for a Yagi-Uda array of slot antennas will be presented. The analysis utilizes a multiline transmission line network model to capture the mutual coupling of the slot antennas. The multiline network parameters use the two-line solution for coupling (even/odd mode analysis) allowing the presented analysis to be generalized to any transmission line based antenna. The network parameters will be shown to provide an array factor for the Yagi-Uda array - predicting the radiative and directive properties of the array in a closed-form analysis. The results from the analytical model will be presented in comparison to full-wave simulations and measurements.