‘Analytical Model of Interwoven Spiral Arrays’

Presented by Dr Alexander Schuchinsky, Reader, School of EEECS

Interweaving planar spiral conductors in doubly periodic arrays enables substantially sub-wavelength resonant response across a broad fractional bandwidth. A self-contained analytical model has been developed to accurately predict the response of intertwined quadrifilar spiral array near its fundamental resonance. The model, based upon a multiconductor transmission line (MTL) approach, provides physical insight into the unique properties of the distributed interactions between the interleaved counter-wound spirals spread beyond a single unit cell and elucidates the mechanisms underlying the array performance at normal and oblique incidence of TE and TM polarised waves. The developed MTL model is instrumental for the design of the artificial surfaces with the specified response prediction of their performance.

‘X-Parameters - Salvation at Hand?’

Presented by Mr Dmitry Kozlov, ECR Marie Curie, HFEC

S-parameters have been used to characterize linear circuits for design and simulation since the 1960s. Designers could integrate S-parameters “black-boxes” with other electrical components. However, classic S-parameters are only valid under linear operating conditions. They cannot be used to describe nonlinear distortions. Therefore, nonlinear device characterization has been limited.

X-parameters are mathematically rigorous supersets of S-parameters, applicable to nonlinear components under both large-signal and small-signal conditions. They include the magnitude and phase characteristics of spectral components corresponding to distortion, which can include harmonics and intermodulation products, in addition to those spectral components present in the incident signal. X-parameters represent both the nonlinear characteristics of the component due to a large-signal stimulus, and the spectrally linearized response around the large-signal state of the system to additional injected signals, that now depends nonlinearly on the component operating conditions that are determined by the large-signal excitation. Using X-parameter approach, we can correctly predict the nonlinear behaviour of the device under complex stimulus and the response of cascaded nonlinear components in the same way as using common S-parameters.
Thursday 10th April 2014
12.30-13.00, ECIT Seminar Room

“Third and Fifth Harmonic Peaking Class-EF Amplifiers”

Presented by Mr Ayman Barakat, ECR Marie Curie, HFEC

This seminar will introduce two new architecture designs of a low-voltage-stress Class-EF power amplifier (PA) that extend the maximum operating frequency, named as “third-harmonic-peaking Class-EF PA” and “fifth-harmonic-peaking Class-EF PA”. A novel transmission-line load network is proposed to meet the Class-EF impedance requirements at the fundamental, all even harmonics, and third harmonic components. They also provide an impedance matching to a 50 Ω load. A more effective λ/8 open- and shorted-stub network is deployed at the drain of the transistor replacing the traditional λ/4 transmission line. The theory and practical design will be discussed.

Thursday 22nd May 2014
12.30-13.00, ECIT Seminar Room

“Nonreciprocal Scattering by Stacked Nonlinear Magneto-active Semiconductor Layers”

Presented by Dr Oksana Shramkova, HFEC

The combinatorial frequency generation by the periodic stacks of magnetically biased semiconductor layers has been modelled in a self-consistent problem formulation, taking into account the nonlinear dynamics of carriers. It is shown that magnetic bias not only renders nonreciprocity of the three-wave mixing process but also significantly enhances the nonlinear interactions in the stacks, especially at the frequencies close to the intrinsic magneto-plasma resonances of the constituent layers. The main mechanisms and properties of the combinatorial frequency generation and emission from the stacks are illustrated by the simulation results, and the effects of the individual layer parameters and the structure arrangement on the stack nonlinear and nonreciprocal response are discussed.

Please send your comments and suggestions to a.shitov@qub.ac.uk