Metamaterial Formalism Approach to Recognize Cancer

T Gric[1] and E Rafailov[2]

[1]*Department of Electronic Systems, Vilnius Gediminas Technical University, Vilnius, Lithuania*
[2]*Aston University, Birmingham, UK*
Contact Email: tatjana.gric@vilniustech.lt

Early detection of a tumor makes it more probable that the patient will, finally, beat cancer and recover. The main goal of broadly defined cancer diagnostics is to determine whether a patient has a tumor, its location and histological type and severity. The characteristic of the cancer affected tissue is the presence of the glioma cells in the sample. The current approach in diagnosis focuses mainly on microbiological, immunological, and pathological aspects rather than on the "metamaterial geometry" of the diseases. The determination of the effective properties of the biological tissue samples and treating them as disordered metamaterial media has become possible with the development of effective medium approximation techniques. Their advantage lies in their capability to treat the biological tissue samples as metamaterial structures. Here, we present, for the first time to our knowledge, the studies on metamaterial properties of biological tissues to identify pathological areas in the brain tissue. The results show that the metamaterial properties are influenced by the tissue type, if it is healthy or unhealthy. The obtained effective permittivity values are affected by various factors, like the amount of different cell types in the sample and their distribution. The identification of the cancer affected areas based on their effective medium properties was performed. These results prove the metamaterial model capability in recognition of the pathological areas. The presented approach can have a significant impact on the development of methodological approaches toward precise identification of pathological tissues and would allow for efficient detection of cancer-related changes.