Abstract:
Mathematical frameworks for representing fields and waves and expressing Maxwell's equations of electromagnetism include vector calculus, differential forms, dyadics, bivectors, tensors, quaternions, and Clifford algebras. Vector notation is by far the most widely used, particularly in applications. Of the more sophisticated notations, differential forms stand out as being close enough to vectors that most practitioners can readily understand the notation, yet at the same time offering unique visualization tools and graphical insight into the behavior of fields and waves. We survey recent papers and book on differential forms and review the basic concepts, notation, graphical representations, and key applications of the differential forms notation to Maxwell's equations and electromagnetic field theory.