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J. P. Moitinho de Almeida, P. Díez, C. Tiago and N. Parés (Eds)

A CLASS OF PIOLA-KIRCHHOFF HYBRID STRESS FINITE ELEMENTS FOR ELASTODYNAMICS

J.P. MOITINHO DE ALMEIDA[*] AND HUGO A.F.A. SANTOS[†]

[*] Department of Civil Engineering, Architecture and Georesources
Instituto Superior Técnico
Av. Rovisco Pais 1, 1049 -001 Lisboa, Portugal
e-mail: moitinho@civil.ist.utl.pt

[†] Wolfson School of Mechanical and Manufacturing Engineering
Loughborough University
Loughborough, Leicestershire LE11 3TU, U.K.
email: hugofreixialsantos@gmail.com

Abstract. We introduce a novel hybrid stress finite element formulation for two-dimensional linear electrodynamics. This approach is an extension of the Piola-Kirchhoff hybrid stress formulation that we have recently proposed for linear elastostatics [1], and is applied in this communication to problems in the frequency domain. The formulation is consistent with a complementary form of the Hamiltonian variational principle, which involves, as fundamental unknown variables, the stress field components and boundary displacements. The approximate stress fields are split into two parts: a divergence-free (static) part, taken as the solution of the homogeneous momentum equations, and a dynamic part, taken as the particular solution of the momentum equations. The key ingredient of the formulation is to explicitly approximate, in the parent domain, either the second Piola-Kirchhoff stresses, the first Piola-Kirchhoff stresses, the Cauchy stresses, or rather their combination, and to enforce the divergence-free condition in the physical domain by means of a suitable projection. The main advantage of this formulation over traditional hybrid stress formulations [2] is that it allows to consider arbitrarily shaped elements without necessarily compromising static admissibility. Feasibility and effectiveness of the proposed formulation will be numerically demonstrated through the analysis of benchmark tests, which will also consider the problem of characterizing the properties of the error of these solutions.

REFERENCES

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