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Abstract

ERMES 20.0 is an open-source software which solves the Maxwell's equations in frequency domain with the Finite Element Method (FEM). The new ERMES 20.0 is a significant upgrade from the previous ERMES 7.0 [1]. It introduces new features, modules, and FEM formulations to address the challenging problems commonly encountered in the design and analysis of nuclear fusion reactors [2]. Key additions are the electrostatic and cold plasma module, along with new FEM formulations as the stabilized double-curl edge element formulation [3] and the local L^2 projection method with nodal and bubble elements [4, 5]. Furthermore, all the formulations now include an A-V potentials version. The ample set of methods available in the new ERMES 20.0 allows the user to select the most suitable FEM formulation to generate the best possible conditioned matrix for each specific problem.

ERMES 20.0 operates in the static, quasi-static and the high-frequency regimens, making it a versatile tool which can be used in a wide variety of situations. For instance, it had been applied to microwave engineering,

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bioelectromagnetics, and electromagnetic compatibility. Now, thanks to the new electrostatic and cold plasma modules, the range of applications has been extended to relevant nuclear fusion engineering problems as: the computation of induced forces, plasma control, probability estimation of electric arc initiation, current distribution in arbitrary geometries, and the study of electromagnetic wave-plasma-wall interactions inside a fusion reactor.

ERMES 20.0 is available for Windows and Linux systems and it has improved its capabilities to solve large problems on High Performance Computing (HPC) infrastructures thanks to its new interface with the solver libraries PETSc [6] and Python NumPy [7]. As in previous versions, ERMES 20.0 features a graphical user-friendly interface integrated into the pre- and post-processor GiD [8]. GiD handles geometrical modelling, data input, meshing, and result visualization. ERMES 20.0 is licensed under the open-source software 2-clause BSD license.

This document is accompanied by a comprehensive manual that provides a step-by-step installation guide, a detailed description of all the new features and formulations, as well as the executables, user interface, examples, and source code of ERMES 20.0.

NEW VERSION PROGRAM SUMMARY

Program Title: ERMES 20.0
CPC Library link to program files: (to be added by Technical Editor)
Developer's repository link: https://ruben-otin.blogspot.com/
Licensing provisions(please choose one): BSD 2-clause
Programming language: C++
Supplementary material:
Journal reference of previous version: See Reference [1]
Does the new version supersede the previous version?: Yes
Reasons for the new version: This new version is a significant upgrade of the

previous version [1], introducing a suite of new features, modules, and FEM formulations.
Summary of revisions: This document is accompanied by a comprehensive manual that provides a detailed description of all the new features.
Nature of problem: Time-harmonic Maxwell's equations.
Solution method: Finite Element Method.
Additional comments including restrictions and unusual features:

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