

ISSN: 2596-1152





Universidade Federal de Goiás



6

Goiânia | Volume nº 6 | 2019



UNIVERSIDADE FEDERAL DE GOIÁS (UFG)

*Rector*

Edward Madureira Brasil



ESCOLA DE ENGENHARIA ELÉTRICA,  
MECÂNICA E DE COMPUTAÇÃO (EMC)

*Director*

Reinaldo Gonçalves Nogueira



GRUPO PET – ENGENHARIAS (CONEXÕES  
DE SABERES) (PETEECS/UFG)

*Tutor*

Getúlio Antero de Deus Júnior



GRUPO DE EDUCAÇÃO APLICADA EM  
ENGENHARIA E ENGENHARIA APLICADA  
AO ENSINO (ENAEN/UFG)

*Coordinator*

Getúlio Antero de Deus Júnior

#### EDITOR-IN-CHIEF

Getúlio Antero de Deus Júnior, Universidade Federal de Goiás, Goiânia, Brazil

#### EDITOR

Rodrigo Pinto Lemos, Universidade Federal de Goiás, Goiânia, Brazil

#### INTERNATIONAL EDITORIAL COMMITTEE

Aly El-Osery, New Mexico Institute of Mining and Technology, Socorro, The United States of America

Andreia Aoyagui Nascimento, Universidade Federal de Goiás, Goiânia, Brazil

Christian Weiner, Darmstadt University of Applied Sciences, Darmstadt, German

Christof Sumereder, FH Joanneum University of Applied Sciences, Graz, Austria

Emmanuel Daniel, Institute Minés-Télécom Atlantique, Brest, France

Felipe Pamplona Mariano, Universidade Federal de Goiás, Goiânia, Brazil

Getúlio Antero de Deus Júnior, Universidade Federal de Goiás, Goiânia, Brazil

Jesús Mária López Lezama, Universidad de Antioquia, Medellín, Colombia

Leonardo Guerra de Rezende Guedes, Universidade Federal de Goiás, Goiânia, Brazil

Lina Paola Garces Negrete, Universidade Federal de Goiás, Goiânia, Brazil

Lueny Morell, Lueny Morell & Associates and Director of InnovaHiED, Mayagüez, Puerto Rico

Luiz Carlos de Campos, Pontifícia Universidade Católica de São Paulo, São Paulo, Brazil

Marcelo Escobar de Oliveira, Instituto Federal de Goiás, Itumbiara, Brazil  
Marcelo Stehling de Castro, Universidade Federal de Goiás, Goiânia, Brazil  
Marco Antônio Assfalk de Oliveira, Universidade Federal de Goiás, Goiânia, Brazil  
Marcos Lemos Afonso, Universidade Federal de Goiás, Goiânia, Brazil  
Nival Nunes de Almeida, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil  
Natasha Van Hattum-Janssen, Saxion University of Applied Sciences, Enschede, Netherlands  
Rodrigo Pinto Lemos, Universidade Federal de Goiás, Goiânia, Brazil  
Rui Manuel Sá Pereira Lima, Universidade do Minho, Minho, Portugal

## REVIEWERS

Américo Augusto Nogueira Vieira, Universidade Federal do Paraná, Curitiba  
Amilton Costa Lamas, Pontifícia Universidade Católica de Campinas, Campinas  
Andreia Aoyagui Nascimento, Universidade Federal de Goiás, Goiânia, Brazil  
Anna Cristina Barbosa Dias de Carvalho, Faculdade de Tecnologia, Itaquera  
Archimedes Azevedo Raia Junior, Universidade Federal de São Carlos, São Carlos  
Cassio Dener Noronha Vinhal, Universidade Federal de Goiás, Goiânia  
Denise Rauta Buiar, Universidade Tecnológica Federal do Paraná, Curitiba  
Eliomar Araújo de Lima, Universidade de Brasília, Brasília  
Emiliano Lôbo de Godoi, Universidade Federal de Goiás, Goiânia  
Estéfano Vizconde Verasztó, Universidade Federal de São Carlos, Araras  
Felipe Pamplona Mariano, Universidade Federal de Goiás, Goiânia, Brazil  
Frederico Nicolau Cesarino, Universidade Luterana do Brasil, Manaus  
Getúlio Antero de Deus Júnior, Universidade Federal de Goiás, Goiânia  
Igor Kopcak, Universidade Federal de Goiás, Goiânia  
Irlan von Linsingen, Universidade Federal de Santa Catarina, Florianópolis  
Kléber Mendes Figueiredo, Universidade Federal de Goiás, Goiânia  
Leonardo de Queiroz Moreira, Universidade Federal de Goiás, Goiânia  
Leonardo Guerra de Rezende Guedes, Universidade Federal de Goiás, Goiânia  
Luiz Carlos de Campos, Pontifícia Universidade Católica de São Paulo, São Paulo  
Luiz Carvalho, Universidade Federal do Rio de Janeiro, Rio de Janeiro  
Luiz Eugenio Veneziani Pasin, Universidade Federal de Itajubá, Itajubá  
Mara Marly Gomes Barreto, Universidade Federal do ABC, Santo André  
Marcelo Stehling de Castro, Universidade Federal de Goiás, Goiânia  
Maria Assima Bittar Gonçalves, Universidade Federal de Goiás, Goiânia  
Maria Cristina Kessler, Universidade do Vale do Rio dos Sinos, São Leopoldo  
Marlize Garcia Fagundes Neto, Universidade Federal de Goiás, Goiânia  
Mauricio Leonardo Aguilar Molina, Universidade Federal de Juiz de Fora, Juiz de Fora  
Miguel Angel Chincaro Bernuy, Universidade Tecnológica Federal do Paraná, Cornélio Procópio  
Reinaldo Gonçalves Nogueira, Universidade Federal de Goiás, Goiânia  
Rodrigo Cutri, Instituto Mauá de Tecnologia, São Caetano do Sul  
Rodrigo Pinto Lemos, Universidade Federal de Goiás, Goiânia  
Sarajane Marques Peres, Universidade de São Paulo, São Paulo  
Sergio Pires Pimentel, Universidade Federal de Goiás, Goiânia  
Sigeo Kitatani Júnior, Universidade Federal de Goiás, Goiânia  
Ubirajara Carnevale de Moraes, Universidade Presbiteriana Mackenzie, São Paulo  
Warley Teixeira Guimarães, Faculdades Integradas São Pedro, Vila Velha

SISTEMA ELETRÔNICO DE EDITORAÇÃO DE REVISTAS (SEER)

Cássia Oliveira Santos, Biblioteca Central (BC/UFG)  
Cláudia Oliveira de Moura Bueno, Biblioteca Central (BC/UFG)

SECRETARY

Huesdra Nogueira Campos (EMC/UFG)

STANDARDS FOR THE PREPARATION OF MANUSCRIPTS EDITOR

Getúlio Antero de Deus Júnior (EMC/UFG)

PAPERS EDITORS

Getúlio Antero de Deus Júnior (EMC/UFG)  
Huesdra Nogueira Campos (EMC/UFG)  
Bruno Lúcio Mendes Fontes (EMC/UFG)  
Lucas Ribeiro Marquies (EMC/UFG)  
Alexandre Godinho de Oliveira (EMC/UFG)  
Isabela Magalhães Barcelos Costa (EMC/UFG)  
Isabela Lopes Magalhães (EMC/UFG)  
Isabela Fontes de Araújo (EMC/UFG)  
Lucas Wallace Nascimento Lima (EMC/UFG)

LANGUAGE REVIEWERS

Authors are responsible for reviewing their papers by an expert in English language.

GRAPHIC DESIGNER

Getúlio Antero de Deus Júnior (EMC/UFG)

WEBSITE DESIGNERS

Getúlio Antero de Deus Júnior (EMC/UFG)  
Huesdra Nogueira Campos (EMC/UFG)

LATEX DESIGNERS

Bruno Lúcio Mendes Fontes (EMC/UFG)  
Lucas Ribeiro Marquies (EMC/UFG)  
Alexandre Godinho de Oliveira (EMC/UFG)  
Cecília de Sousa Luz Almeida (EMC/UFG)  
Lucas Wallace Nascimento Lima (EMC/UFG)

SPECIAL SUPPORT

Grupo PET - Engenharias (Conexões de Saberes) (PETEECS/UFG)  
Grupo de Educação Aplicada em Engenharia e Engenharia Aplicada em Educação (EnAEn/UFG)  
Laboratório de Engenharia Multimeios (Engemulti/UFG)  
Pró-Reitoria de Pós-Graduação (PRPG/UFG)

The Grupo de Educação Aplicada em Engenharia e Engenharia Aplicada em Educação (EnAEn/UFG) of the Escola de Engenharia Elétrica, Mecânica e de Computação (EMC) of the Universidade Federal de Goiás (UFG) promotes The International Journal on Alive Engineering Education (IJAEdu). The journal publishes issues every six months and receives papers in continuous flow, so there will be no deadlines for submitting them. IJAEdu provides to professionals and academia an electronic space for the dissemination of technical and scientific works related to Engineering Education in Brazil and other countries.

#### CATALOGUING DATA

---

INTERNATIONAL JOURNAL ON ALIVE ENGINEERING EDUCATION. Journal on the Escola de Engenharia Elétrica, Mecânica e de Computação, UFG, v. 5, 2019 – Goiânia: IJAEEDU/EMC/UFG, 2019 v. 6, 2019.

Semester.

ISSN: 2596-1152

1. Universidade Federal de Goiás – Escola de Engenharia Elétrica, Mecânica e de Computação – Journals.

---

#### INDEXED IN:

IBICT/SEER (<http://seer.ibict.br/>)  
LATINDEX (<http://www.latindex.org/>) (In progress)

#### CONTACT FOR EXCHANGE

SIBI/UFG, Biblioteca Central, Seção de Seleção, Aquisição e Intercâmbio  
Campus Samambaia, Caixa Postal 411, CEP 74001-970, Goiânia-GO

#### CONTACT FOR SIGNATURE

No signatures. The journal can be accessed through the electronic address: <http://www.emc.ufg.br/ijaeedu>

#### CONTACT FOR CORRESPONDENCE

Escola de Engenharia Elétrica, Mecânica e de Computação (EMC/UFG), Avenida Universitária, n.º 1488, quadra 86, bloco A, 3º piso, Setor Leste Universitário, Goiânia-GO, CEP 74605-010.

Phones: (62) 3209-6079, (62) 3209-6070. Fax: (62) 3209-6292.

URL: <http://www.emc.ufg.br/ijaeedu>. E-mail: [ijaeedu.emc@gmail.com](mailto:ijaeedu.emc@gmail.com).



# Editorial

This is the fourth issue of this journal that will be fully published in English language. In fact, the International Journal on Alive Engineering Education (IJAEdu) has been published truly in continuous flow from this issue. Thus, it will be necessary to publish one issue of the journal per annual volume. Therefore, rarely an editorial will be necessary. Like this, the first paper published in this issue show the Environmental Education and Energy Efficiency as strategies for reducing energy consumption in public school building in Goiânia (Brazil).

What are the next papers? I do not know. However, the readers can expect very interesting papers. Topics include, but will not be limited to:

Accreditation	Adaptive Learning
Assessment and Evaluation	Big Data and Analytics in Higher
Education	Case Studies
Cloud-based Learning	Computational Thinking
Computer-Based Learning	Continuing Education
Curriculum Design	Distance and Flexible Education
Education Model	Educational Games and Simulations
Educational Leadership and Administration	Educational Policy
E-Learning	Engineering Education
Entrepreneurship Programs	Ethical and Social Justice Issues
Faculty Development	Industry Linkages and Partnerships
Innovation Programs	Instructional Design
Interdisciplinary Teaching Approaches	Internet of Things in Education
Laboratory Experiences	Learning Management Systems
Marketing for Engineering Programs	Massive Open Online Course (MOOC)
Mobile Learning	Open Education Resources (OER)
Problem-based Learning (PBL)	Project Led Education (PLE)
Research Training	Semantic Methodologies
Service Learning	Work-Based Education
Work-Integrated Education	Among others

In fact, any article in the area of “Alive Engineering Education” is very welcome. By the way, it is important to note that this term was coined by the IJAEdu team and the IJAEdu topics are in line with International Conference on Alive Engineering Education (ICAEEdu). We took the opportunity to invite our readers to participate in the ICAEEdu 2019. It will be held on 23-28 June in Strasbourg, Alsace, France at L’amphithéâtre A207, Télécom Physique Strasbourg Pôle API (Parc d’Innovation).

We also remind our authors who they are responsible for the “Copyright Transfer Agreement and Letter to The Editors” term by submitting an article electronically in the IJAEdu. On the other hand, an author confirms the acceptance of the Copyright term in the act of submitting an article. So, there is a double confirmation when a paper is accepted and published.

From this edition (volume 6, 2019), the IJAEdu has a New International Standard Serial Number: ISSN 2596-1152. This was necessary on account of Latindex, our first indexing in international index base (in progress). From this issue, all articles will be submitted to Similarity Check.

The IJAEdu team thanks for the confidence in our work by all the actors involved: readers, authors, reviewers, International Editorial Committee, SEER team, secretary, paper editors, website designers, latex designers and special support.

Getúlio Antero de Deus Júnior, Editor-In-Chief



# Contents

1. See the Contents online:

<https://revistas.ufg.br/ijaeedu/issue/view/2095>

