

The PHILIPPINE ENGINEERING JOURNAL serves as a national medium of exchange of technical information and dissemination of engineering knowledge through the publication of technical papers, technical notes, and research briefs. Published by the U.P. Engineering Research and Development Foundation, Inc. for the National Engineering Center, the PHILIPPINE ENGINEERING JOURNAL is being distributed at reasonable rates to various government agencies, private industrial concerns, engineering schools, professional organizations, international entities and practitioners in the field of engineering.

ISSN 0117 5564

RIZALINDA L. DE LEON, Ph.D.

*Executive Director
National Engineering Center*

Louis Angelo Danao, Ph.D.

Editor-in-Chief

EDITORIAL BOARD

Dr. Menandro Berana

Dr. Ariel Blanco

Dr. Leslie Ann Diaz

Dr. John Richard Hizon

Dr. Iris Ann Martinez

Dr. Prospero Naval

Dr. Joey Ocon

Dr. Michael Angelo Pedrasa

Dr. Augustus Resurreccion

Dr. Karl N. Vergel

Arlene De Ocampo

*Head, Engineering Information and Marketing Division
National Engineering Center*

Erwin Gabriel

Publication Staff

INTERNATIONAL ADVISORY BOARD

Dr. Sheree Pagsuyoin

University of Massachusetts Lowell, USA

Dr. Greg Foliente

University of Melbourne, Australia

Dr. Joost Santos

George Washington University, USA

Dr. Jiro Takemura

Tokyo Institute of Technology, Japan

Dr. Masahiko Nagai

Yamaguchi University, Japan

Dr. Christian Della

University of Glasgow, Singapore

Dr. Chong Meng Nan

Monash University Malaysia

Prof. Emmanuel Manlapig

University of Queensland, Australia

EXTERNAL ASSOCIATE EDITORS

Dr. Hongbo Cong

University of Akron, USA

Dr. Mary Lyn Lim

Coatings Innovation Center, USA

Dr. Aristotle Ubando

De La Salle University