



Republic of the Philippines  
**CEBU NORMAL UNIVERSITY**  
Osmeña Blvd. Cebu City, 6000 Philippines

**RESEARCH INSTITUTE**  
FOR COMPUTATIONAL  
MATHEMATICS AND PHYSICS  
Email: ricmp@cnu.edu.ph  
Website: www.cnu.edu.ph/ricmp/home



---

## ANNUAL REPORT

(C.Y. 2019)

This report is based on the following goals of the Research Institute for Computational Mathematics and Physics:

- Perform research of high quality in the field of computational mathematics and physics
- Develop tools and methodologies based on computational mathematics and physics for the use in teaching and learning as well as in industries.

Below are the highlights of the accomplishments of the research institute for CY 2019:

- ✓ The institute has produced the following completed researchers and publications in SCOPUS and ISI-indexed journals:

Title	Status	Date of Completion/ Publication/Presentation
<b>First Kind <math>r</math>-Whitney Numbers For Complex Arguments</b>	Completed  Published <b>Journal of Inequalities and Special Functions</b> , Volume 10 (1) (2019), pp. 85-92. <b>(Indexed by Web of Science (ESCI))</b>	February 2019
<b>Multi Poly-Bernoulli and Multi Poly-Euler Polynomials</b>	Published (Online) <b>Applied Mathematical Analysis: Theory, Methods, and Applications. Studies in Systems, Decision and Control</b> , Volume 177. Springer, Cham. <b>(Indexed by SCOPUS)</b>	February 2019
<b>Hankel Transform of <math>(q,r)</math>-Dowling Numbers</b>	Published <b>European Journal of Pure and Applied Mathematics</b> Volume 12(2) (2019), 279-293.	April 2019

(Funded by CHED-GIA)	(Indexed by Web of Science (ESCI) and SCOPUS)	
<b>Hurwitz Lerch type Multi-Poly-Cauchy Numbers</b>	Published <b>Mathematics</b> Volume 7(4) (2019), 335; Available Online at <a href="https://doi.org/10.3390/math7040335">https://doi.org/10.3390/math7040335</a> . (Indexed by Web of Science (SCIE) and SCOPUS)	May 2019
<b>The <math>r</math>-Bell Numbers and Matrices Containing Non-Central Stirling and Lah Numbers</b>	Published  <b>Journal of Mathematics and Computer Science</b> , Volume 19 (2019), pp. 181-191.  (Indexed by Web of Science (ESCI) and SCOPUS)	June 2019
<b>Analogies of the Qi Formula for Some Dowling-Type Numbers</b>	Published <b>Utilitas Mathematica</b> , Volume 111 (2019), pp. 3-26. (Indexed by Web of Science (SCIE) and SCOPUS)	June 2019
<b>Some Theorems on Tauber's Generalized Stirling, Lah, and Bell Numbers</b>	Published  <b>European Journal of Pure and Applied Mathematics</b> , Volume 12(3) (2019), pp. 1069-1081. (Indexed by Web of Science (ESCI) and SCOPUS)	July 2019
<b>On Multi Poly-Bernoulli Polynomials</b>	Published  <b>Journal of Inequalities and Special Functions</b> , Volume 10 Issue 2 (2019) pp. 21-34.  (Indexed by Web of Science (ESCI))	July 2019
<b>Approximations of Genocchi Polynomials in Terms of Hyperbolic Functions</b>	Published (Online) <b>Asian-European Journal of Mathematics</b> (2021) 2150083, 14 pages. DOI: 10.1142/S1793557121500832 (Indexed by Web of Science (ESCI) and Scopus)	July 2019

<p><b>The r-Dowling Numbers and Matrices Containing r-Whitney Numbers of the Second Kind and Lah Numbers</b></p> <p>(Funded by CHED-GIA)</p>	<p>Published</p> <p><b>European Journal of Pure and Applied Mathematics</b>, Volume 12(3) (2019), pp. 1122-1137.  <b>(Indexed by Web of Science (ESCI) and SCOPUS)</b></p>	<p>July 2019</p>
<p><b>Numerical Calculation of the Real r-Lambert Function</b></p> <p>(Funded by CHED-GIA)</p>	<p>Published</p> <p><b>Journal of Inequalities and Special Functions</b>, Volume 10(3) (2019), pp. 44-49..  <b>(Indexed by Web of Science (ESCI))</b></p>	<p>September 2019</p>
<p><b>Hankel Transform of the Second Form (q,r)-Dowling Numbers</b></p> <p>(Funded by CHED-GIA)</p>	<p>Published</p> <p><b>European Journal of Pure and Applied Mathematics</b> Volume 12(4) (2019), pp. 1676-1688.  <b>(Indexed by Web of Science (ESCI) and SCOPUS)</b></p>	<p>November 2019</p>
<p><b>A Qi formula for translated r-Dowling numbers</b></p>	<p>Published</p>	<p>November 2019</p>

✓ The institute has organized/conducted the following research training workshops:

Event	Brief Description	Resource Speaker(s)/Expert(s)	Output
<p><i>Training Workshop on Latex</i></p> <p><b>Date:</b> April 29-30, 2019  <b>Venue:</b> RICMP Computer Laboratory, 6<sup>th</sup> Floor TAC</p>	<p>L<sup>A</sup>T<sub>E</sub>X is a computer program for typesetting documents. It takes a computer file, prepared according to the rules of L<sup>A</sup>T<sub>E</sub>X and converts it to a form that may be printed on a high-quality printer, such as a laser writer, to produce a printed</p>	<p><b>Roberto B. Corcino</b>  <b>Jay M. Ontolan</b></p> <p>Research Institute for Computational Mathematics and Physics</p>	<p>Articles written in Latex format</p>

<p>Building, Cebu Normal University, Cebu City</p>	<p>document of a quality comparable with good quality books and journals.</p> <p>Most of the highly-indexed journals accept only submissions written in Latex format (e.g. journals published by Elsevier and Springer). With this information, active researchers in CNU must be equipped with the skills in type setting their research paper/ articles in Latex format.</p> <p>This training workshop would train the participants on how to prepare articles in Latex format for submission to the aforementioned indexed journals.</p>		
<p><i>Training On Data Analytics Using Tableau</i>  <b>Date:</b> June 26-28, 2019  <b>Venue:</b> Rumah Highlands Hotel, Cebu City</p> <p><b>Participants:</b>  <i>All researchers in RICMP and faculty of Math and Physics Department</i></p>	<p>Tableau is rapidly becoming the software of choice for business data visualization. Tableau's functionality allows the researcher to slice data along many different dimensions in order to explore the underlying structure of the overall data set. Another interesting feature of the software is Tableau's ability to visualize multiple dimensions in a two-dimensional space, enhancing the researcher's ability to</p>	<p><b>Dr. Johnny Snyder</b>  <i>Colorado Mesa University</i></p>	<p>Research Proposals:</p> <ol style="list-style-type: none"> <li>1) Visual Exploration of Patterns of the Effects of Some Factors Affecting Life Expectancy</li> <li>2) Visual Analytics of Crime Statistics in the Philippines Using Tableau</li> <li>3) Earthquake Occurrences</li> </ol>

	<p>explore patterns in the data set.</p> <p>This multi-day seminar will introduce the audience to the basic functionality of Tableau, beginning with definitions of the workspace, and continuing with an introduction to basic graphing capabilities. The seminar will then introduce the audience to advanced graphing techniques and the analytical capabilities of the software.</p>		
<p><i>Lecture Series and Training On Combinatorial And Statistical Applications Of Generalized Bell Numbers And Their Hankel Transform</i></p> <p><b>Date:</b> September 30-October 2, 2019</p> <p><b>Venue:</b> Azia Suites and Residences, Cebu City</p> <p><b>Participants:</b> <i>All researchers in RICMP and selected researchers from Visayas and Mindanao</i></p>	<p>This training offers an opportunity to learn advance combinatorics. In particular, the generalized Bell numbers and their Hankel transform will lead to close-form solutions for discontinuous boundary-condition problems. Problems of this type may have solutions in a form of an infinite range integral with a singular point and special functions in the integrand which evaluation might be too difficult. Hankel transform may give a convenient and practical algorithm to transform original solutions as a series form.</p>	<p><b>Dr. Nicolas Privault</b> Division of Mathematical Sciences, Nanyang Technological University (NTU), Singapore</p> <p><b>Roberto B. Corcino</b> Research Institute for Computational Mathematics and Physics</p>	<p>Research Proposals</p>

<p><i>Lecture Series and Research Training on Lambert W Function: Reimann Surfaces</i></p> <p><b>Date:</b> October 21-23, 2019  <b>Venue:</b> Palm Grass Heritage Hotel, Cebu City</p> <p><b>Participants:</b>  <i>All researchers in RICMP and selected researchers from Visayas and Mindanao</i></p>	<p>The research training has equipped the participants with additional knowledge about Lambert W Function, particularly, the concept of Reimann Surfaces which helps describe the branches of the function in complex case. The project aims to generate a mathematically sound result on the said function in a general case. One of the deliverable of this CHED funded project is to invite an expert in this field to enhance the capability of the research team to do the project and get it done in due time. Moreover, the project includes information dissemination to individuals from other regions, specifically from Mindanao and some parts of Visayas, for future research collaboration.</p>	<p><b>Dr. Istvan Mezo</b></p> <p>Nanjing University of Information Science and Technology, CHINA</p>	<p>Research Problems on Generalized Lambert W Function</p>
--	---	--	--

✓ The researchers of the institute have attended the following seminars, trainings, and conferences:

<b>Name of Seminars, Trainings, and Conferences</b>	<b>Date and Venue</b>	<b>Involvement</b>	<b>Acquired</b>
<p><i>2019 Annual Convention of the Mathematical Society of the Philippines</i></p>	<p><b>Date:</b> 27–29 May 2019  <b>Venue:</b> Greenleaf Hotel, General Santos City</p>	<p><b>Chairman of the Convention:</b>  <i>Dr. Roberto B. Corcino, RICMP Director</i></p> <p><b>Poster Presenter:</b>  <i>Dr. Roberto B. Corcino</i></p> <p><b>Paper Presented:</b></p>	<p>Institute popularity</p> <p>Research Dissemination</p>

		<p>1) <i>Hurwitz Lerch Multi Poly-Cauchy Polynomials</i> By Dr. Roberto B. Corcino</p> <p>2) Expansion of Genocchi Polynomials with Enlarged Region of Validity</p> <p>By Dr. Cristina B. Corcino</p> <p><b>Participants:</b> Dr. Cristina B. Corcino Jeneveb T. Malusay</p>	<p>Updates on new research trends in mathematics</p> <p>New research methods in math modelling</p>
<i>1<sup>st</sup> International Conference on Arts and Sciences (ICAS 2019)</i>	<p><b>Date:</b> September 18-19, 2019 <b>Venue:</b> Cebu Normal University</p>	<p><b>Judge for Best Paper Presentation:</b> Dr. Roberto B. Corcino</p> <p><b>Participants:</b> All RICMP Researchers</p>	<p>Updates on new research trends in arts and sciences</p>
<i>Festival on Innovation and Research (FIRE 2019)</i>	<p><b>Date:</b> October 17-19, 2019 <b>Venue:</b> Cebu Normal University, Cebu City</p>	<p><b>Paper Presented:</b></p> <p>1) <i>The Quadratic Lambert Function and Its Applications</i> By Dr. Cristina B. Corcino</p> <p>2) <i>The Hankel Transform of the Second Form (q,r)-Dowling Numbers</i> By Dr. Roberto B. Corcino</p> <p><b>Participant:</b></p>	<p>Institute popularity</p> <p>Research Dissemination</p> <p>Updates on new research trends in mathematics</p> <p>New research methods in math modelling</p>

		<i>Jenevab T. Malusay – Co-author of the Paper Presented</i>	
<i>2019 MSP Cebu Research Congress and Convention</i>	<b>Date:</b> November 14-15, 2019 <b>Venue:</b> Bayfront Hotel, Cebu City	<b>Convention Chair:</b> Dr. Cristina B. Corcino  <b>Member of Organizing Committee:</b> Dr. Roberto B. Corcino (President, MSP Cebu Chapter)  <b>Paper Presenter:</b> Dr. Cristina B. Corcino	Institute popularity  Research Dissemination  Updates on new research trends in mathematics  New research methods in math modelling

- ✓ The institute has two (2) externally funded research projects, which officially started on June 3, 2019. Below are the said research projects funded by CHED-GIA.

<b>Title of the Research Project</b>	<b>Status</b>	<b>Funding Agency/Project Cost</b>
<b><i>HANKEL TRANSFORM OF <math>q</math>- ANALOGUE OF <math>r</math>-DOWLING NUMBERS</i></b> <i>by Roberto B. Corcino, Jay M. Ontolan and Istvan Mezo</i>	Officially started on June 3, 2019	<b>CHED-GIA</b> <b>Project Cost: PhP 2,457,961.10</b>
		<b>CHED-GIA</b>



<p><b>THE GENERALIZED LAMBERT W FUNCTION, ITS PROPERTIES AND APPLICATIONS</b>  <i>by Cristina B. Corcino, Roberto B. Corcino, Wilson Castañeda and Istvan Mezo</i></p>	<p>Officially started on June 3, 2019</p>	<p><b>Project Cost: PHP 3,142,038.90</b></p>
--	---	--

✓ The institute has acquired four research staffs for the CHED funded research project.

- 1) **Gladys Jane Rama** - Research Assistant for Component Project 1: Hankel Transform of  $q$ -Analogue of  $r$ -Dowling Numbers;
- 2) **Wilson Castañeda** - Research Assistant for Component Project 2: The Generalized Lambert W Function, Its Properties and Applications;
- 3) **Michelle Ann H. Silva** – Clerk-Encoder for Component Project 1: Hankel Transform of  $q$ -Analogue of  $r$ -Dowling Numbers;
- 4) **Jeremar Casquejo** - Clerk-Encoder for Component Project 2: The Generalized Lambert W Function, Its Properties and Applications.

✓ Consultancy Services:

Dr. Roberto B. Corcino (RICMP Director) served as dissertation adviser of the following:

1. **Dr. Noel Lacpao (CHED Scholar)**

Degree: *Doctor of Philosophy in Mathematics*

School: *Mindanao State University-Iligan Institute of Technology*

Dissertation Title: *Hurwitz Lerch Type Multi-Poly-Cauchy Numbers and Polynomials*

Status: *Graduated in Summer 2019*

2. **Dr. Mary Joy R. Latayada (CHED Scholar)**

Degree: *Doctor of Philosophy in Mathematics*

School: *Mindanao State University-Iligan Institute of Technology*

Dissertation Title: *Hankel Transform of  $(q, r)$ -Dowling Numbers*

Status: *Graduated in Summer 2019*

Prepared by:

**ROBERTO B. CORCINO, Ph.D.**

Director, Research Institute for Computational Mathematics and Physics