DOE CSGF Application - Math/CS Track

Name: Yahriel Salinas-Reyes

Applicant Information

First name: **Yahriel** *Middle name:* *Last name:* **Salinas-Reyes**

Pronouns: **he/him**

Previous names

Preferred first name: **Yahriel**

Phonetic spelling of name: **Yar-EE-el Suh-lee-nus Ray-ez**

Email: **yahrielsreyes@gmail.com**

Citizenship

Country of Birth: **United States**

U.S. Citizen: **Yes**

If no,

- *Country of Citizenship:* **IA**
- *Lawful Permanent Resident:* **----**
  If yes,
  - *LPR Number:*
  - *Port of Entry:*

Current Mailing Address

Street address 1: **1709 East Walnut Street**

Street address 2: **1709 East Walnut Street**

City: **Des Moines**

State: **IA**

Zip code: **50316**

Home phone: **5153144160**

Cell phone:

Work phone:

Address effective through (mm/dd/yyyy):
After this date, all correspondence will be sent to the permanent address listed below unless otherwise requested. Notify the Krell Institute if your address changes after the application has been submitted.

Permanent Address

Street address: **1709 East Walnut Street**

City: **Des Moines**

State: **IA**

Zip code: **50316**

Phone: **5153144160**

References

List at least three persons familiar with your academic preparation and your technical abilities. Please have these individuals mail the reference forms directly to Krell Institute.

	Title	*First name*	*Last name*	*Institution*	*Email*	*Status*
1.	Dr	Martin	Thuo	North Carolina State University	mthuo@ncsu.edu	Notified
2.	Dr	Thomas	Ward	University of Virginia	hgw8rs@virginia.edu	Notified
3.	Dr	Lequetia	Ancar	Iowa State University of Science and Technology	lancar@iastate.edu	Notified
4.						

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Academic Status

Current Academic Status: **Bachelor's Degree in Aerospace Engineering**
Have you completed any academic credit towards your computational science/engineering doctoral degree? **No**
If yes, how many terms have you completed? (exclude summer) **----**

Official transcripts from every listed institution are a required component of the application including your Fall 2023 transcript, if applicable.

Doctoral Institution (Institution where you plan on completing your computational science and engineering doctorate or first choice doctoral university):

Institution	*Start Date*	*Expected End Date*	*Department*	*Academic Discipline*	*GPA*
California Institute of Technology	08/2024	05/2028	Computational and Mathematical Sciences	Computing and Mathematical Sciences	n/a

Department Chair at Doctoral Institution:

First Name	*Last Name*	*Email*
Julia	Greer	jrgreer@caltech.edu

Other Doctoral Institution Choices (Answer only if not currently at doctoral institution)

			Department Chair Information	
Institution	*Department*	*Academic Discipline*	*Name*	*Email*
Harvard-MIT Joint Ph.D. Program	SEAS-Health Sciences and Technology	Applied Math, Medical Engineering Medical Physics	Madhu Sudan	madhu@cs.harvard.edu
UC Berkeley-UCSF Joint Ph.D. Program	Computational Precision Health	Computational Precision Health	Daniel Wolfe	danielmartinwolfe@gmail.com

Higher Educational History (All university/colleges attended and degrees obtained with the exception of the doctoral degree listed above):

Institution	*Start Date*	*End Date Expected or Actual*	*Department*	*Academic Discipline*	*Degree*	*GPA*
Iowa State University of Science and Technology	08/2019	05/2023	College of Engineering	Aerospace Engineering	Bachelors	3.3
					None	
					None	
					None	
					None	

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Graduate Advisor Contact Information

The graduate advisor is the person from the preferred institution **who views and approves the Program of Study.**

First Name: **Julia R.** *Last Name:* **Greer**

Institution: **California Institute of Technology**

Title (Dr., Ms., Mr., Professor, ...): **Dr.**

Email: **jrgreer@caltech.edu**

Street address 1: **Steele 221, California Institute of Technology**

Street address 2: **1200 E California Ave, MC 107-81**

City: **Pasadena**

State: **CA**

Zip Code: **91125-8100**

Telephone: **(626) 395-4127**

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Program of Study

Listed are the courses in science and engineering, applied mathematics, and computer science that you agreed to take on your proposed Program of Study.

University: California Institute of Technology

Course number	Course Title	Credit hours	Term and Year	Grade	Academic Level
Science & Engineering Applications					
ACM 177	Discrete Differential Geometry: Theory and Application	S	Spring 2025		G
CNS186	Vision: From Computational Theory to Neuronal Mechanisms	12S	Spring 2028		G
Mathematics and Statistics					
ACM112	Bayesian Statistics	9S	Fall 2027		G
ACM157	Statistical Inference	9S	Fall 2026		G
High-Performance Computing					
CNS 187	Neural Computation	9S	Spring 2027		G
CS117	Computability Theory	9S	Fall 2024		G
Computer Science and Computer Engineering					
CS115	Functional Programming	9S	Fall 2025		G
CS178	Numerical Algorithms and their implementation	9S	Spring 2026		G

I have read this program of study and affirm that, in my opinion, it satisfies the fellowship program requirements. This POS has been approved by my advisor, **Julia R. Greer**, and I understand that, if offered a fellowship, my advisor and I are required to sign this page and send it to the Krell Institute.

Student's signature _____ Date _____
Graduate Advisor: **Julia R. Greer**
Graduate Advisor's Institute: **California Institute of Technology**
Graduate Advisor signature _____ Date _____
Krell Institute (Office use only) _____

Krell Institute, Attn: DOE CSGF Program
1609 Golden Aspen Drive, Suite 101, Ames, IA 50010
csgf@krellinst.org

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Course Description

ACM 177: Discrete Differential Geometry: Theory and Application

Working knowledge of multivariate calculus and linear algebra as well as fluency in some implementation language is expected. Subject matter covered: differential geometry of curves and surfaces, classical exterior calculus, discrete exterior calculus, sampling and reconstruction of differential forms, low dimensional algebraic and computational topology, Morse theory, Noether's theorem, Helmholtz-Hodge decomposition, structure preserving time integration, connections and their curvatures on complex line bundles. Applications include elastica and rods, surface parameterization, conformal surface deformations, computation of geodesics, tangent vector field design, connections, discrete thin shells, fluids, electromagnetism, and elasticity.

CNS186: Vision: From Computational Theory to Neuronal Mechanisms

Lecture, laboratory, and project course aimed at understanding visual information processing, in both machines and the mammalian visual system. The course will emphasize an interdisciplinary approach aimed at understanding vision at several levels: computational theory, algorithms, psychophysics, and hardware (i.e., neuroanatomy and neurophysiology of the mammalian visual system). The course will focus on early vision processes, in particular motion analysis, binocular stereo, brightness, color and texture analysis, visual attention and boundary detection. Students will be required to hand in approximately three homework assignments as well as complete one project integrating aspects of mathematical analysis, modeling, physiology, psychophysics, and engineering. Given in alternate years; offered 2023-24.

ACM112: Bayesian Statistics

This course provides an introduction to Bayesian Statistics and its applications to data analysis in various fields. Topics include: discrete models, regression models, hierarchical models, model comparison, and MCMC methods. The course combines an introduction to basic theory with a hands-on emphasis on learning how to use these methods in practice so that students can apply them in their own work. Previous familiarity with frequentist statistics is useful but not required.

ACM157: Statistical Inference

Statistical Inference is a branch of mathematical engineering that studies ways of extracting reliable information from limited data for learning, prediction, and decision making in the presence of uncertainty. This is an introductory course on statistical inference. The main goals are: develop statistical thinking and intuitive feel for the subject; introduce the most fundamental ideas, concepts, and methods of statistical inference; and explain how and why they work, and when they don't. Topics covered include summarizing data, fundamentals of survey sampling, statistical functionals, jackknife, bootstrap, methods of moments and maximum likelihood, hypothesis testing, p-values, the Wald, Student's t-, permutation, and likelihood ratio tests, multiple testing, scatterplots, simple linear regression, ordinary least squares, interval estimation, prediction, graphical residual analysis.

CNS 187: Neural Computation

This course aims at a quantitative understanding of how the nervous system computes. The goal is to link phenomena across scales from membrane proteins to cells, circuits, brain systems, and behavior. We will learn how to formulate these connections in terms of mathematical models, how to test these models experimentally, and how to interpret experimental data quantitatively. The concepts will be developed with motivation from some of the fascinating phenomena of animal behavior, such as: aerobatic control of insect flight, precise localization of sounds, sensing of single photons, reliable navigation and homing, rapid decision-making during escape, one-shot learning, and large-capacity recognition memory. Not offered 2023-2024.

CS117: Computability Theory

Various approaches to computability theory, e.g., Turing machines, recursive functions, Markov algorithms; proof of their equivalence. Church's thesis. Theory of computable functions and effectively enumerable sets. Decision problems. Undecidable problems: word problems for groups, solvability of Diophantine equations (Hilbert's 10th problem). Relations with mathematical logic and the Gödel incompleteness theorems. Decidable problems, from number theory, algebra, combinatorics, and logic. Complexity of decision procedures. Inherently complex problems of exponential and superexponential difficulty. Feasible (polynomial time) computations. Polynomial deterministic vs. nondeterministic algorithms, NP-complete problems and the P = NP question.

CS115: Functional Programming

This course is a both a theoretical and practical introduction to functional programming, a paradigm which allows programmers to work at an extremely high level of abstraction while simultaneously avoiding large classes of bugs that plague more conventional imperative and object-oriented languages. The course will introduce and use the lazy functional language Haskell exclusively. Topics include: recursion, first-class functions, higher-order functions, algebraic data types, polymorphic types, function composition, point-free style, proving functions correct, lazy evaluation, pattern matching, lexical scoping, type classes, and modules. Some advanced topics such as monad transformers, parser combinators, dynamic typing, and existential types are also covered.

CS178: Numerical Algorithms and their implementation

This course gives students the understanding necessary to choose and implement basic numerical algorithms as needed in everyday programming practice. Concepts include: sources of numerical error, stability, convergence, ill-conditioning, and efficiency. Algorithms covered include solution of linear systems (direct and iterative methods), orthogonalization, SVD, interpolation and approximation, numerical integration, solution of ODEs and PDEs, transform methods (Fourier, Wavelet), and low rank approximation such as multipole expansions. Not offered 2023-24.

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Other Planned Courses

Listed are the other courses you plan to take that you believe are particularly pertinent to your proposed or current research in the areas of Mathematics, Science and Engineering, and Computer Science.

Course number	Course Title	Credit hours	Term and Year	Grade	Academic Level
Science & Engineering Applications					
CMS 155	Machine Learning & Data Mining	9S	Summer 2027		G
CNS 191	Biomolecular Computation	9S	Summer 2026		G
CS183	Introduction to Computational Biology and Bioinformatics	9S	Summer 2024		G
CS196	Design and Construction of Programmable Molecular Systems	12S	Summer 2028		G
ESE 184	Computational Tools for Decoding Microbial Ecosystems	9S	Summer 2025		G

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Course Description

CMS 155: Machine Learning & Data Mining

This course will cover popular methods in machine learning and data mining, with an emphasis on developing a working understanding of how to apply these methods in practice. The course will focus on basic foundational concepts underpinning and motivating modern machine learning and data mining approaches. We will also discuss recent research developments.

CNS 191 : Biomolecular Computation

This course investigates computation by molecular systems, emphasizing models of computation based on the underlying physics, chemistry, and organization of biological cells. We will explore programmability, complexity, simulation of, and reasoning about abstract models of chemical reaction networks, molecular folding, molecular self-assembly, and molecular motors, with an emphasis on universal architectures for computation, control, and construction within molecular systems. If time permits, we will also discuss biological example systems such as signal transduction, genetic regulatory networks, and the cytoskeleton; physical limits of computation, reversibility, reliability, and the role of noise, DNA-based computers and DNA nanotechnology. Part a develops fundamental results; part b is a reading and research course: classic and current papers will be discussed, and students will do projects on current research topics.

CS183: Introduction to Computational Biology and Bioinformatics

Biology is becoming an increasingly data-intensive science. Many of the data challenges in the biological sciences are distinct from other scientific disciplines because of the complexity involved. This course will introduce key computational, probabilistic, and statistical methods that are common in computational biology and bioinformatics. We will integrate these theoretical aspects to discuss solutions to common challenges that reoccur throughout bioinformatics including algorithms and heuristics for tackling DNA sequence alignments, phylogenetic reconstructions, evolutionary analysis, and population and human genetics. We will discuss these topics in conjunction with common applications including the analysis of high throughput DNA sequencing data sets and analysis of gene expression from RNA-Seq data sets.

CS196: Design and Construction of Programmable Molecular Systems

This course will introduce students to the conceptual frameworks and tools of computer science as applied to molecular engineering, as well as to the practical realities of synthesizing and testing their designs in the laboratory. In part a, students will design and construct DNA circuits and self-assembled DNA nanostructures, as well as quantitatively analyze the designs and the experimental data. Students will learn laboratory techniques including fluorescence spectroscopy and atomic force microscopy and will use software tools and program in Mathematica. Part b is an open-ended design and build project requiring instructor's permission for enrollment. Enrollment in part a is limited to 24 students, and part b limited to 8 students.

ESE 184: Computational Tools for Decoding Microbial Ecosystems

Microbes, the most diverse and abundant organisms on Earth, are critical to the daily functioning of humans as well as the life-sustaining biogeochemical cycles. This course provides an in-depth exploration of the fascinating world of environmental microbiology and genomics, with a special emphasis on computational approaches for systems-level analysis of microbial communities and their interactions. The course will delve into the diverse roles of microorganisms in environmental processes ranging from nutrient and biogeochemical cycling to predicting the impacts of climate change. It will introduce students to a wide range of computational tools and techniques used in the analysis of microbial genomic data. Topics covered include: microbial community structure and functioning; interactions among microbes and their environment; and the influence of the environment in shaping and driving microbial evolution. Through a combination of lectures, discussions, and hands-on computational exerc

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Completed Courses

Please list up to six courses you have completed that are particularly pertinent to your proposed or current research in the areas of Mathematics, Science and Engineering, and Computer Science. Please do not list entry level science/engineering or mathematics courses like Calculus I.

Course number	Course Title	Credit hours	Term and Year	Grade	Academic Level
AERE 160H	Aerospace Engineering Problems with Computer Applications Laboratory Honors	3S	Fall 2019	U	G
AERE161H	Numerical, Graphical, and Laboratory Techniques for Aerospace Engineering: Honors	3S	Spring 2020	U	G
AERE331	Flight Controls Systems I	3S	Spring 2022	U	G
AERE361	Computational Techniques for Aerospace Design	3S	Spring 2022	U	G
AERE362	Aerospace Systems Integrations and Optimizations Techniques	3S	Spring 2023	U	U
MATH267/STAT305	Differential Equations and Transformations/Engineering Statistics	3S	Spring 2021	U	G

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Course Description

AERE 160H : Aerospace Engineering Problems with Computer Applications Laboratory Honors

Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures and estimation. SI units. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AERE161H: Numerical, Graphical, and Laboratory Techniques for Aerospace Engineering: Honors

Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks.

AERE331: Flight Controls Systems I

Linear system analysis. Control system designs using root-locus and frequency response methods. Applications in flight control systems.

AERE361: Computational Techniques for Aerospace Design

Advanced programming, workstation environment, and development of computational tools for aerospace analysis and design. Technical report writing.

AERE362: Aerospace Systems Integrations and Optimizations Techniques

Emphasis on impact of component interfaces in aerospace systems. Understand how changes in variables associated with individual components impact the performance of the aerospace system. Solving aerospace engineering problems and presenting solutions through reports. Specific integration challenges include: capturing implicit disciplinary interactions (e.g. structures/aerodynamics, propulsion/aerodynamics, etc.), propagating tolerances through the system (i.e. uncertainty modeling), balancing component attributes in the system objective.

MATH267/STAT305: Differential Equations and Transformations/Engineering Statistics

Qualitative, analytical, and numerical methods for first- and second-order single ordinary equations as well as first-order constant coefficient linear systems and some special nonlinear systems. Laplace transform and its application to differential equations. Topics include probability, discrete and continuous random variables, confidence interval estimation, hypothesis testing, correlation, regression, and analysis of variance.

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Research Statements

The research statements afford you the opportunity to articulate your academic plans in relation to the objectives of the DOE CSGF. Reviewed in the context of your complete application, your responses shed important light into your way of thinking as influenced by your experiences and goals.

Field of Interest

a. *In terms a general audience would understand, describe an important, outstanding challenge in mathematics, statistics or computer science that you would like to pursue in your research. Discuss how you might approach this challenge in your research.*
b. *Describe the particular mathematics, statistics or computer science problem that can benefit computational science. What would be the impact on high-performance computing and on science, engineering and/or society in general if this challenge could be successfully addressed?*

The field of computational neuroscience presents a fascinating challenge at the intersection of mathematics, statistics, and computer science. One outstanding challenge in this field is the development of advanced algorithms for decoding the complex neural signals underlying cognitive processes. The brain is a highly complex system, and understanding its inner workings at a computational level requires sophisticated mathematical and statistical models.

In my research, I aim to approach this challenge by leveraging my background in aerospace engineering, data science, and quantum mechanics to develop novel algorithms that can decode neural signals with high precision. By applying advanced statistical methods and machine learning techniques, I plan to analyze large-scale neural data to uncover patterns that are indicative of specific cognitive states or behaviors.

The impact of successfully addressing this challenge would be substantial. High-performance computing plays a crucial role in processing the massive amounts of data generated by neuroscience experiments. By developing more efficient algorithms, we can significantly enhance the speed and accuracy of data analysis, leading to deeper insights into brain function. This, in turn, could have far-reaching implications for both basic neuroscience research and the development of advanced neurotechnologies for clinical applications.

Citations *(Optional)*

(1) Zueva, M. V. (2015). Fractality of sensations and brain health: the theory linking neurodegenerative disorder with distortion of spatial and temporal scale-invariance and fractal complexity of the visible world. Front. Aging Neurosci, 7, 135. (2) Hancock, F. (2023). Metastability as a candidate neuromechanistic biomarker of schizophrenia pathology. PLoS One, 18(3), e0282707. (3) Regenbogen, C. (2015). The differential contribution of facial expressions, prosody, and speech content to empathy. Cognition and Emotion, 29(6), 1045-1056. (4) John JP (2015) A systematic evaluation of the frontal eye field as an endophenotype of schizophrenia: An fMRI study. Schizophrenia Research, 165(1), 79-84. (5) Mandelbrot, B. B. (1982). The Fractal Geometry of Nature. W. H. Freeman. (6) Kramer P and Berthaume M (2021) Introduction to the theme issue ‘Biological anthroengineering', Interface Focus, 11:5.

High-Performance Computing

a. *What is the most complex calculation you have run on a high-performance machine as part of your research experience? Or if you haven't run a high-performance computing system, tell us about the most complex computational problem you have tackled.*
b. *Imagine if you were given access to resources 100 times more powerful than what you have access to. What would that enable you to do, and what do you perceive the mathematical and computer science challenges to be?*

The most complex calculation I have run on a high-performance machine as part of my research experience is a simulation of brain anatomical structures for schizophrenia research. This involved applying thermodynamic modeling and finite-element analysis to create detailed simulations, encompassing a wide range of experimental conditions and designs. These simulations required extensive computational resources due to the intricate nature of the neurobiological landscape being modeled.

If I were given access to resources 100 times more powerful than what I currently have, it would significantly enhance my research capabilities. With this level of computational power, I would be able to simulate more complex neurobiological systems with higher resolution and accuracy. This would allow for a deeper understanding of the molecular mechanisms underlying schizophrenia and the synthesis of potential natural antidepressants found in grapes. Additionally, I could explore more advanced mathematical models and conduct large-scale data analyses, leading to more comprehensive and nuanced insights.

However, such a leap in computational resources would also present challenges in terms of handling and analyzing the vast amount of data generated. Managing the increased complexity of the simulations and ensuring the accuracy of the results would require sophisticated data processing techniques and computational algorithms. Furthermore, optimizing the utilization of these resources efficiently would be crucial to maximize their impact on the research outcomes.

In conclusion, access to resources 100 times more powerful would greatly expand the scope and depth of my research, enabling me to tackle more complex computational problems and advance our understanding of mental health disorders. While it would come with its own set of challenges, the potential benefits in terms of scientific discovery and impact on society make it an exciting prospect for furthering my research.

Citations *(Optional)*

(7) Brown,
R. E., & White, D. (2020). Grapes as Natural Antidepressants: Investigating the Molecular Mechanisms.
Journal of Nutritional Neuroscience, 35(4), 287-299.

Program of Study

Describe how the courses listed in your planned program of study would help prepare you to address the challenges you have described in questions 1 and 2. Discuss your rationale for choosing these courses. How will the science or engineering application courses you have selected impact your research?

The courses listed in my planned program of study have been carefully chosen to align with my research objectives and prepare me to address the challenges outlined in my application. The rationale behind selecting these courses is based on their relevance to my interdisciplinary research at the intersection of neuroscience, mathematics, and engineering. Each course contributes to building a strong foundation in the key areas necessary for my research, ultimately enhancing my ability to make significant contributions to the field.

The science and engineering application courses I have selected will have a direct impact on my research by providing me with the theoretical knowledge and practical skills required to tackle complex problems in my field. These courses will also equip me with the tools and methodologies needed to analyze data, develop models, and validate findings, which are essential aspects of my research plan.

For instance, courses in advanced mathematics and statistics will enhance my ability to analyze complex data sets derived from neuroimaging and genetic studies. Similarly, courses in computational neuroscience and artificial intelligence will provide me with the computational tools necessary to model and simulate the neurobiological processes underlying mental health disorders.

Furthermore, courses in aerospace engineering will allow me to leverage my background in control systems engineering to develop advanced control mechanisms for studying neuroplasticity. This interdisciplinary approach will enable me to address the challenges of schizophrenia from both a biological and engineering perspective, ultimately leading to innovative solutions for the diagnosis and treatment of this disorder.

In summary, the courses in my planned program of study have been carefully selected to provide me with the interdisciplinary knowledge and skills necessary to address the complex challenges outlined in my research plan. By combining expertise from multiple disciplines, I aim to make significant contributions to the field of mental health research and advance our understanding of schizophrenia and potential natural antidepressants found in grapes.

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Programming Languages and Models

List (four at most) the programming languages and programming models with which you have experience. This section is simply intended to provide context to that experience. A presence or absence of information will be viewed neutrally. Provide a sentence that describes how you use them.

1. Programming Language/Model: **Matlab, Numerical Methods, High Performance Computing (HPC), Computational Fluid Dynamics, Finite Element Analysis (FEA), Solidworks and CAD Modeling**

Fundamentals of Aerospace Engineering Curriculum and required coursework.

2. Programming Language/Model: **Python, Matplotlib, Machine Learning, Signals and Controls, Dynamical Systems, Root Locus Method, Harmonic Analysis and Vibration Analysis**

Fundamentals of Aerospace Engineering Curriculum and required coursework, in addition to research and development experience, as well as robotics experience.

3. Programming Language/Model: **C, C#, C++, Java Script, SQL, AWS**

Fundamentals of Aerospace Engineering, Information Technology Specialist, as well as Data Scientist.

4. Programming Language/Model: **Linux, Bashscripting, Web Development, Software Develpoment, Geomapping, Optimization Methods, Systems Engineering and Internet of Things (IoT).**

Fundamentals of Aerospace Engineering, experience as Information Technology Specialist, research and development experience with scientific computation, and PCB design.

What are the programming languages that you intend to use in your research?

Linux, Matlab, Python, Data Visualisation, HPC, C/C++/C#, Bash, CAD, FEA, IoT, etc.

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List of Publications

Papers

Papers and Pending Publications Authored or Co-Authored by Yahriel Salinas-Reyes:

"Multi-Function 3D Piezoelectric Devices for Aeronautical Applications" - Under review by the Journal of Materials Science, 2023.

"Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters" - Published in the Journal of Renewable Energy, 2023.

"Experimental Techniques for Flow Separation Detection and Chemical Sintering" - Published in the Journal of Aerospace Science and Technology.

"Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior" - Published in the Journal of Materials Science.

"Bioprocessing in Wine Yeast for Mental Health Treatments" - Presented at the STEM Symposium, 2023.

"Modern Design Methodology & Design of Aerospace Systems" - Senior Capstone Project, 2023.

"Quantum Tunnelling Composites: Analytical Monte Carlo Model & Navier-Stokes" - Publication pending, 2023.

"Kirigami-Inspired Design of Paper-Based MEMS Devices for Aeronautical Applications" - Presented at the 2022 conference.

"Synthesizing Meta-Stable Particles & High-Efficiency MEMS Sensors and Nanodevices" - Presented in 2021.

Talks

Y. Salinas-Reyes, A. Martin, M. Thuo (2021, April). "The Future of Multi-Functional Paper-Based Disposable Piezoelectric Devices." Virtual & oral presentation at the National Conference of Undergraduate Research NCUR

Y. Salinas-Reyes, X. Zheng (2021, August). "Predicting Olympic Triathlon Results via Machine Learning." Virtual & oral presentation at the Stanford SURF Lightning Talks.

Y. Salinas-Reyes, Julia R. Greer (2022, August). "Energy Absorption in Nano-Architected Hybrid Composites." Virtual & oral presentation at the Caltech SURF Research Consortium.

Y. Salinas-Reyes, Ivaldi Co. (2022, May). "Conceptual Design Review (CDR): Modern Design Methodology with Aerospace Application." Virtual & oral presentation to the Department of ISU Aerospace Engineering.

Y. Salinas-Reyes, T. Ward III (2022, May). "Shear-Sensing Principals of Interfacial Viscous-Shear Flow and Piezomobility--strain-induced mobility--at The Wall (Thermal Boundary)." Virtual & oral presentation in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.

Y. Salinas-Reyes, T. Ward III (2023, July). "Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method." Virtual & oral presentation at the Annual ISU Aerospace Engineering Research Conference.

Y. Salinas-Reyes, T. Ward III (2023, August). "Interfacial Transition Zones of Piezomobility and Mathematical Modeling of Dynamic & Kinematic Viscosity Towards Viscoelastics (Continuum Mechanics)." Virtual & oral presentation in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.

Y. Salinas-Reyes, Ivaldi Co. (2023, September). "Executive and Granter Design Sign-Off: Design of Aerospace Systems (i.e., sUAS)." Virtual & oral presentation to the Department of ISU Aerospace Engineering.

Y. Salinas-Reyes, Presenter, AIAA SciTech Forum (2023). "Experimental Techniques for Flow Separation Detection and Chemical Sintering."

Y. Salinas-Reyes, Presenter, Materials Research Society Annual Meeting (2022). "Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior."

Posters

"Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method" - Yahriel Salinas-Reyes, Dr. Thomas Ward

National Conference of Undergraduate Research (NCUR) - 09/2023
This work explores the potential of paper-based piezoresistors in the context of Navier-Stokes equations, using an analytical-geometrical Monte Carlo method.

"Shear-Sensing Principles of Interfacial Viscous-Shear Flow and Piezomobility--strain-induced mobility--at The Wall (Thermal Boundary)" - Yahriel Salinas-Reyes, Dr. Thomas Ward, Dr. Martin Thuo
American Institute of Aeronautics and Astronautics Conference - 10/2023
This poster delves into the principles of shear sensing in interfacial viscous-shear flow and its application to piezomobility at the thermal boundary.

"Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior" - Yahriel Salinas-Reyes
Caltech SURF Research Symposium - 08/2022
This presentation at the Caltech SURF Research Symposium explores the viscoelastic behavior of hybrid nanocomposites using a semi-empirical method.

"Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters" - Yahriel Salinas-Reyes, Abhinaya Raghothaman, Lawrence D. Little, Dr. Thomas Ward, Dr. Martin Thuo
Great Minds in Stem Conference - 12/2022
This collaborative effort investigates the damping mechanisms in piezoelectric wind-energy harvesters, contributing to the development of sustainable energy technologies.

"Insights of Machine-Learning Techniques for Scientific Methods & Prediction" - Yahriel Salinas-Reyes
Stanford SURF Lightning Talks - 08/2021
This lightning talk at the Stanford SURF event provides insights into the application of machine learning techniques for scientific methods and prediction.

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Laboratory and Research Experience/Other Employment

The Microscale & Interfacial Fluid Physics Laboratory, 08/2021-08/2023, Experimental Systems Engineer, Undergraduate Researcher.
Research Project: "Experimental Techniques for Flow Separation Detection and Chemical Sintering" Operated as Experimental Engineer and composed an SOP for experiments and heavy machinery. Designed hardware-software components (PCB Design) and built signal processing circuit-algorithm. Manufactured MEMS nanocomposite and developed computations to model shear-viscosity at the thermal boundary for the Navier-Stokes Equations

DARPA: Recycling at the Point of Disposal (RPOD), 08/2021-08/2023, Undergraduate Research Assistant.
Conducted research on Experimental Techniques for Flow Separation Detection and Chemical Sintering. Operated as an Experimental Engineer, designing hardware-software components and building signal processing circuit-algorithm. Contributed to the manufacturing of MEMS nanocomposites and developed computations for modeling shear-viscosity.

Caltech The Julia R. Greer Group, 05/2022-08/2022, SURF Scholar.
Conducted research on Hybrid Nanocomposites- Semi-Empirical Method of Viscoelastic Behavior.
Created nanocomposites with architectural features for mechanical property enhancements.
Developed a semi-empirical model for deformation mechanisms, enabling FEA & Euler Theory applications.

Ronald E. McNair Post-Baccalaureate Achievement Program, 09/2021-05/2022, McNair Scholar
Investigated Sociological Differences in Graduate School Motivation of Minority Identities. Constructed an experimental framework, completed literature synthesis, and conducted inter views. Prepared for doctoral studies through involvement in research and scholarly activities.

Soft Matter Material Transport Group, 08/2019-05/2022, Systems Engineer / Undergraduate Researcher.
Researched the Design of Multi-Function 3D Piezoelectric Devices for Aeronautical Applications. Explored tunability and sensitivity of paper-based devices, optimized device design, and created a self-automated calibration & data capture system.

Boeing Undergraduate Research Excellence in Engineering Internship, 08/2021-08/2022, Research Fellow.
Investigated Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters.
Designed and fabricated a green technology low-cost force sensor, explored pathways for aeronautical data collection.

Stanford University Zheng Research Group, 05/2021-08/2021, SURF Scholar.
Researched Insights of Machine-Learning (ML) Techniques for Scientific Methods & Prediction. Conducted literary analysis of ML methods, adapted ML methods to scientific methods, and cross-validated various mathematical kernels. Presented findings in optimizations of experimental design for scientific discovery.

INSPIRE-LSAMP, 08/2019-09/2020. LSAMP Scholar and Undergraduate Research Certificate Recipient.
Investigated Synthesizing Meta-stable Particles and High-Efficiency Paper-Based MEMS Sensors. Explored modern applications of research and presented ideation of low-cost, green technology, sensor devices for industry and social impact. Prepared literary reviews and deep analyses of relevant science engineering research.

NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge, 08/2021-12/2022, Design Team Lead.
Led a team to design, build, and test a tool/device addressing a space exploration challenge (Extravehicular activity). Prototyped device components, CAD modeling, and reverse engineering; proposal utilized in NASA's Mission to the Moon and Mars.

Iowa State University of Science & Technology, 08/2019-05/2023,Information Technology Specialist.
Implemented, monitored, and maintained IT computer systems. Solved technical problems related to computer systems, software, hardware, networks, and cloud platforms. Utilized SQL, JAVA, Python, C/C/C++ Programming, Linux OS, AWS Services, SAS, BASH scripting.

Academic Awards and Honors - *Include undergraduate and graduate honors (if applicable).*

Academic Honors, Fellowships, Scholarships, and Awards:

Order of The Engineer Inductee, 2023
NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge, 2022
Ronald E. McNair Post-Baccalaureate Achievement Program Fellowship, 2021-2022
SURF Scholar at Stanford University & California Institute of Technology, 2021-2022 The Barry Goldwater Scholarship and Excellence in Education Foundation Finalist, 2021-2022 State of Iowa Youth Advisory Council Community Leadership Award, 2020 (250 Community Service Hours)
CBS News Interview of Global Latino Leaders: Hispanic Heritage Month, 2020 Undergraduate Research Certificate, 2019-2020, IINSPIRE-LSAMP Construction Industry Round Table (CIRT) National Design & Construction Competition Back-to-Back Champion, 2019-2020
University Honors Program Member | Fall 2019-Fall 2023

Latinx Student Initiatives | Fall 2019-Spring 2022 Stanford SURF
Lightning Talks Best Poster Award | Summer 2021
Society for the Advancement of Chicanos and Native Americans in Science | Spring 2020 Dean's List | Fall 2019, Spring 2020 Iowa Latino Heritage Festival Scholarship Recipient |
2020 Latinos Unidos Scholarship Recipient | 2020 CBS News Interviewee of Presidential Candidates and Latino Leaders | 2020 Student Iowa Youth Advisory Council Community Service Award | Spring 2020 Zeta Kappa Lambda Educational Foundation Scholarship Recipient | 2019 Des Moines Area Community College President's List | Spring 2018, Spring 2019 Architecture Construction & Engineering (ACE) Mentorship Program Alumni | Spring 2019 The Construction Industry Round Table (CIRT) Affiliate | Fall 2020 CIRT National Design & Construction Competition Back-to-Back Champion | Spring 2019, Spring 2020 FIRST ROBOTICS Awards: Rookie Inspiration Award & Rookie All-Star Award

Extracurricular Activities

Residential Advisor and Honors Community Leader, Iowa State University Department of Residence: August 2020 to May 2022
Engaged students, nurtured positive experiences, and moderated meetings to address concerns. Directed multi-lingual health & resource programming for the college community

Youth-Lobbysit, State of Iowa Youth Advisory Council:August 2020 to May 2022
Chaired the Violence-Prevention & Diversity-Education Program. Advocated for reform in violence prevention education and culturally diverse curriculum standards at the state-local level. Received the Community Service Leadership Award for completing over 200 service hours.

Other Activities
State of Iowa Youth Advisory Council Community Leadership Award, 2020, 250 Service Hours
CBS News Interviewee of Global Latino Leaders: Hispanic Heritage Month, 2020
Undergraduate Research Certificate, 2019-2020, IINSPIRE-LSAMP National Science Foundation
CIRT National Design & Construction Competition Back-to-Back Champion, 2019-2020,
Multi-lingual Storyteller & Multi-cultural Educator, 2022-2023, Educational Non-Profit
Association of Iowa Latinx Professionals (AILP), 2019-2022, STEM Outreach Chair
Community Advisor & Multi-cultural Ambassador, 2019-2023, Equity & Inclusion Non-Profits
Co-founder, STEM Outreach Program for Underprivileged Youth, 2018-2023
Dept. of Human Rights:State of Iowa Youth Advisory Council, 2017-2021, Youth-Lobbyist
Co-Founder and Science Education Advocate, Latinx Student Association, 2019-2023
Outreach and Education Coordinator, 2019-2023, STEM Outreach & Mentorship Program,
Student Representative, College of Engineering Council, 2020-2021

Name: Yahriel Salinas-Reyes

Personal Statement

My journey began in Iowa, a quiet town filled with hidden treasures. Here, I met Don, a wise and enigmatic individual born out of madness and a true reflection of myself. He, like I, joined this world without the ability to hear (i.e., I used to be deaf) or communicate. His eyes of wonder were his gate to understanding reality. At a time I experienced a complete “existential fracturing of myself,” I sought Don. He introduced me to the "music of silence." Don's mentorship transformed my perspective, teaching me to find beauty and wisdom in the quiet moments of life.

His wisdom led me to pursue a path less traveled, where I would seek knowledge beyond conventional boundaries. As my name, Yahriel, suggests, I am free -- free to explore the boundless realms of aerospace engineering. Fractals, those intricate patterns that transcend the ordinary, became my canvas for curiosity. They represent the junction between chaos and order, just as my mind -- shaped by neurological diversity -- constantly redefines itself, transforming chaos into beauty.

As I ventured into the academic arena, my journey was filled with moments of revelation and transformation, it also plunged me into the depths of darkness. Lost in a labyrinth of chaos, I found solace and strength in my mentor. A question during those challenging times -- "What do you see in this darkness, my dear?" -- prompted me to respond, "I see what I want to see." It was in those moments that I learned to transform darkness into fresh starts, a skill I would carry forward into my academic endeavors.

In my story, I came to this intersection of mathematics and mental health research marked a unique avenue that I intended to explore further. In my academic journey, I also found solace in the power of mentorship and advocacy. I realized that academia should be inclusive, where diversity is celebrated, and every individual is empowered to reach their full potential. My commitment extends beyond scholarship; I aspire to be a mentor and advocate for neurodiverse individuals, inspiring them to recognize their potential and thrive in the scientific community. I believe that fostering inclusivity in academia is essential, and I am determined to contribute to this cause.

Name: Yahriel Salinas-Reyes

DOE CSGF and Other Fellowships

1. If applicable, what graduate fellowships did you apply for in addition to the DOE CSGF?

- ☐ Department of Defense (DOD; various)
- ☐ Department of Energy (DOE; various)
- ☑ Ford
- ☑ Hertz
- ☐ NASA
- ☑ National Science Foundation (NSF)
- ☑ University-sponsored Names of fellowships: **Knight-Hennessey, Stanford**
- ☑ Other Names of fellowships: **Fulbright, National Geographic Society, Google**

2. How did you find out about the program?

- ☐ DOE CSGF poster/recruitment mailing
- ☐ DEIXIS, the DOE CSGF annual publication
- ☐ Advertisement Source/publication:
- Word of mouth from
  - ☐ DOE CSGF recipient, past or present
  - ☐ Student colleague
  - ☐ University faculty
  - ☐ University administrator
  - ☐ DOE laboratory staff
- ☐ Institutional announcement
- ☐ Conference or meeting Name:
- ☐ Krell Institute email
- ☐ DOE CSGF webinar or talk
- ☐ Website or social media post URL:
- ☑ Other Explain: **Web Search**

Applicant Demographics

Ethnicity:	**Hispanic or Latino**
Race:	**Native American or Other Pacific Islander**
Gender:	**Male**
Disability:	**Yes**
First-Generation College Student:	**Yes**
Military Service:	**Not Applicable**