

TITLE AND DESCRIPTION OF INVENTION

TITLE OF INVENTION:

DATeS: Data Assimilation Testing Suite

BRIEF DESCRIPTION OF INVENTION:

DATeS is a unified testing suite for data assimilation applications. The core of DATeS is implemented in Python to enable for Object-Oriented capabilities. The main functionalities, such as the models, the data assimilation algorithms, the linear algebra solvers, and the time discretization routines are independent of each other, such as to offer maximum flexibility to configure data assimilation applications. DATeS can interface easily with large third-party models written in Fortran or C, and with various external solvers.

*Also, please be sure to attach a **comprehensive description of the invention to this form**, including a detailed description of experimental results, figures and/or tables that support your conclusions and proposed uses. Please feel free to add short statements indicating other possible conceptual uses, in addition to the ones that you have already demonstrated. Review of the disclosure and protection of the invention will be delayed without a comprehensive description.*

RELEVANT SPONSORSHIP AND OTHER AGREEMENTS

- | YES | NO | | | | | | | | | | | | | |
|-------------------------------------|-------------------------------------|---|------------------------|----------------|-------------|------------------------|-------|----------------------|--------|----------|-----|-------------|--------|----------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. WAS THIS INVENTION DEVELOPED WITH THE USE OF ANY EXTERNALLY SPONSORED GRANT/CONTRACT FUNDS? IF YES, PLEASE IDENTIFY ALL AGREEMENTS BELOW: | | | | | | | | | | | | |
| | | <table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; width: 30%;">AGENCY OR SPONSOR</th> <th style="text-align: left; width: 30%;">GRANT/CONTRACT</th> <th style="text-align: left; width: 20%;">VT FUND NO.</th> <th style="text-align: left; width: 20%;">PRINCIPAL INVESTIGATOR</th> </tr> </thead> <tbody> <tr> <td>AFOSR</td> <td>FA9550-12-1-0293-DEF</td> <td>450154</td> <td>A. SANDU</td> </tr> <tr> <td>NSF</td> <td>CCF-1218454</td> <td>479245</td> <td>A. SANDU</td> </tr> </tbody> </table> | AGENCY OR SPONSOR | GRANT/CONTRACT | VT FUND NO. | PRINCIPAL INVESTIGATOR | AFOSR | FA9550-12-1-0293-DEF | 450154 | A. SANDU | NSF | CCF-1218454 | 479245 | A. SANDU |
| AGENCY OR SPONSOR | GRANT/CONTRACT | VT FUND NO. | PRINCIPAL INVESTIGATOR | | | | | | | | | | | |
| AFOSR | FA9550-12-1-0293-DEF | 450154 | A. SANDU | | | | | | | | | | | |
| NSF | CCF-1218454 | 479245 | A. SANDU | | | | | | | | | | | |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | 2. WAS INVENTION DEVELOPED USING ANY VT INTERNAL FUNDS? IF YES, IDENTIFY SOURCE: | | | | | | | | | | | | |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | 3. HAVE YOU ENTERED INTO ANY OTHER AGREEMENTS (I.E. MATERIAL TRANSFER AGREEMENT (MTA), MEMORANDUM OF UNDERSTANDING, CONSORTIUM AGREEMENT, OR CONSULTING AGREEMENT) WHICH MAY GRANT RIGHTS OF ANY SORT IN THIS INVENTION TO A COMPANY OR PARTY OUTSIDE VIRGINIA TECH? IF YES, PLEASE ATTACH. | | | | | | | | | | | | |

DATES OF CONCEPTION, REDUCTION TO PRACTICE, AND PUBLIC DISCLOSURE (See DEFINITIONS for bolded terms)

 DATE THIS INVENTION WAS **CONCEIVED**? 2015

 HAS THE **CONCEPTION** BEEN DOCUMENTED? ☒ YES ☐ NO IF YES, **WHERE**? CS-6404 class project, and presentation slides.

 HAS THIS INVENTION BEEN **REDUCED TO PRACTICE**? ☐ YES ☐ NO IF YES, **WHEN**?

FIRST WRITTEN PUBLICATION IN WHICH AN INVENTOR APPEARS AS AN AUTHOR THAT CONTAINS SUFFICIENT INFORMATION TO ENABLE A PERSON SKILLED IN THE ART IN THIS FIELD TO UNDERSTAND AND TO MAKE AND USE THE INVENTION.

RESPONSE/DESCRIPTION/REFERENCE NA

FIRST PUBLIC ORAL DISCLOSURE BY ONE OF THE INVENTORS TO ENABLE A PERSON SKILLED IN THE ART IN THIS FIELD TO UNDERSTAND AND TO MAKE AND USE THE INVENTION.

RESPONSE/DESCRIPTION/REFERENCE


Presentation in the computational science laboratory (CSL) at Virginia Tech
May-2015

OWNERSHIP DETERMINATION -- VIRGINIA TECH INVENTORS

☐ **Inventor/Originator Owned** We do not believe Virginia Tech has any rights or ownership to the invention disclosed. **DO NOT SIGN BELOW.**

☐ **University Owned** Virginia Tech shall share any royalty income derived from this disclosure according to VT Policy 13000. Virginia Tech inventors must complete Attachment B – Royalty Sharing. **PLEASE SIGN AND DATE BELOW.**

By signing below, all Virginia Tech originators/inventors agree to assign, and do hereby assign, all right, title and interest to this intellectual property to Virginia Polytechnic Institute and State University (VT) and agree to execute all documents as requested, assigning to VT their rights in any patent application or other intellectual property protection filed on this invention, and to cooperate with Virginia Tech Intellectual Properties, Inc. (VTIP) in the protection of this intellectual property. By signing below, the originators/inventors confirm that prior to the execution of this disclosure, they have not granted the right or license to make, use, or sell the disclosed intellectual property to anyone except to VT, nor have they otherwise encumbered their rights, title, and interest in the disclosed intellectual property, nor will they execute any instrument in conflict with this agreement.


INVENTOR (1) SIGNATURE
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8/12/2016
DATE

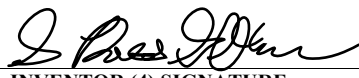
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Original signatures and digital signatures are accepted. Inventors do not need to all sign the same page (multiple copies of this page are acceptable). Please include any non-VT inventors on the next page.

OWNERSHIP DETERMINATION -- VIRGINIA TECH INVENTORS



**Inventor/Originator
Owned**

We do not believe Virginia Tech has any rights or ownership to the invention disclosed.
DO NOT SIGN BELOW.



**University
Owned**

Virginia Tech shall share any royalty income derived from this disclosure according to VT Policy 13000. Virginia Tech inventors must complete Attachment B – Royalty Sharing. **PLEASE SIGN AND DATE BELOW.**

By signing below, all Virginia Tech originators/inventors agree to assign, and do hereby assign, all right, title and interest to this intellectual property to Virginia Polytechnic Institute and State University (VT) and agree to execute all documents as requested, assigning to VT their rights in any patent application or other intellectual property protection filed on this invention, and to cooperate with Virginia Tech Intellectual Properties, Inc. (VTIP) in the protection of this intellectual property. By signing below, the originators/inventors confirm that prior to the execution of this disclosure, they have not granted the right or license to make, use, or sell the disclosed intellectual property to anyone except to VT, nor have they otherwise encumbered their rights, title, and interest in the disclosed intellectual property, nor will they execute any instrument in conflict with this agreement.



8/22/2016

Mahesh Narayanamurthi

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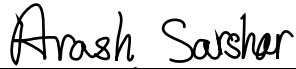
RESIDENCE ADDRESS

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Indian

VT ID NUMBER

CITIZENSHIP



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VT ADDRESS

RESIDENCE ADDRESS

VT ID NUMBER

CITIZENSHIP

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VT ADDRESS

RESIDENCE ADDRESS

VT ID NUMBER

CITIZENSHIP

Original signatures and digital signatures are accepted. Inventors do not need to all sign the same page (multiple copies of this page are acceptable). Please include any non-VT inventors on the next page.

OTHER (NON-VT) INVENTORS

Please provide information for any inventors affiliated with other institutions or companies. The information provided will be used to contact the other inventor(s) if intellectual property protection is pursued on this invention. Signatures of inventors not affiliated with Virginia Tech are not required.

TYPED NAME	TITLE	INSTITUTION/COMPANY AFFILIATION	
INSTITUTION/COMPANY ADDRESS		PHONE	EMAIL
CITIZENSHIP			

TYPED NAME	TITLE	INSTITUTION/COMPANY AFFILIATION	
INSTITUTION/COMPANY ADDRESS		PHONE	EMAIL
CITIZENSHIP			

TYPED NAME	TITLE	INSTITUTION/COMPANY AFFILIATION	
INSTITUTION/COMPANY ADDRESS		PHONE	EMAIL
CITIZENSHIP			

INTELLECTUAL PROPERTY DISCLOSURE

ATTACHMENT A – REVIEW FOR UNIVERSITY OWNERSHIP AND ROYALTY SHARING

To be completed by the university originators/inventors and reviewed by the home Department Head/Center Director of each originator/inventor. If originators/inventors are from different home department(s)/center(s), Attachment A shall be submitted for each unit.

University Ownership

YES NO

- ☒ ☐
1. Were university resources, such as facilities, equipment, materials, funds, information, or the time or services of other university employees, used in the production of the work or development of the intellectual property?
- ☒ ☐
2. Does the work performed in the development of this intellectual property fall within the range of the normal activities expected of the originators/inventors by their appointment or employment by the university (i.e. teaching, research, public service)?
- ☒ ☐
3. Did the originators/inventors work on this project during their normal university working hours?

Exception to Royalty Sharing Eligibility: ☐ YES ☒ NO

1. Did the intellectual property result from tasks and/or activities that were specifically and explicitly assigned to the employee(s) by your unit? In other words, did the employee just perform tasks as assigned, as opposed to providing original intellectual contribution? University Policy 13000 on Intellectual Properties states that revenues from such intellectual property are excepted from royalty sharing with such employee(s).

If yes, the signature below attests that this work was specifically and explicitly assigned to the employee(s) identified as NOT ELIGIBLE below and who cannot share in any royalties:

Signature of Immediate Supervisor

Printed Name/Title of Immediate Supervisor Date

2. If yes, the undersigned university inventors of the intellectual property described in this disclosure acknowledge that this work was specifically and explicitly assigned to us and that we are not eligible to share in any royalties:

INVENTOR NAME (NOT ELIGIBLE FOR ROYALTY SHARING)	SIGNATURE	DATE
INVENTOR NAME (NOT ELIGIBLE FOR ROYALTY SHARING)	SIGNATURE	DATE
INVENTOR NAME (NOT ELIGIBLE FOR ROYALTY SHARING)	SIGNATURE	DATE

Reviewed by Department Head/Center Director

By signing below, I have reviewed and agree to the above determination. (If the Reviewer is an originator/ inventor on this disclosure, his/her administrative supervisor must sign below.) Should any royalties be earned from this disclosure, the home Department/Center of each inventor is entitled to a 10% share divided equally among the departments/centers. Please indicate the home Department/Center Organization Code. The Budget Office will establish the fund based on activity and notify affected departments/centers.

SIGNATURE DATE DEPT/CENTER ORGANIZATION CODE

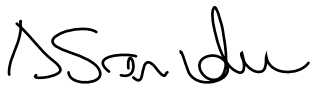

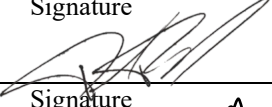
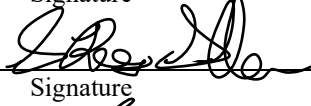


SIGNATURE DATE DEPT/CENTER ORGANIZATION CODE

INTELLECTUAL PROPERTY DISCLOSURE

ATTACHMENT B – ROYALTY SHARING

All royalties, rents, payments, or any cash receipts from the sale, assignment, transfer, licensing or use of the disclosed intellectual property shall be shared with inventors in accordance with VT Policy 13000: Policy on Intellectual Properties.

We, the undersigned university originators/inventors or contributors to of the intellectual property described in this disclosure, mutually agree that any share of revenues to be paid to us shall be distributed as follows:

7/22/2016	Adrian Sandu	9043-27741		12.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
7/22/2016	Ahmed Attia	9057-04635		37.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
8/18/2016	Paul Tranquilli			12.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
8/18/2016	S. Ross Glandon	9053-42708		12.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
8/18/2016	Mahesh Narayanamurthi			12.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
8/18/2016	Arash Sarshar	905808014		12.5
Date	Printed Name	VT ID No.	Signature	Royalty Share*
Date	Printed Name	VT ID No.	Signature	Royalty Share*
Date	Printed Name	VT ID No.	Signature	Royalty Share*

***Percentages must total to 100%. If all university originators/inventors or contributors will share equally, indicate so by listing "equal" as the percentage—DO NOT LEAVE BLANK. VT ID number is required.**

DO NOT INCLUDE NON-UNIVERSITY INVENTORS. Non-university inventors will share in royalties as determined by their employer.

Please be sure to include the date of your signature.

**INTELLECTUAL PROPERTY DISCLOSURE
ATTACHMENT C – COMMERCIAL APPLICATIONS**

Describe the current and/or potential commercial applications for this intellectual property.

- 1) Data assimilation for better weather prediction: insurance companies, department of defense, transportation sector.
- 2) Aeroacoustics and aircraft engineering.

List any potential contacts that you believe may be interested in this technology or may have background and expertise in the technology area(s) related to this intellectual property.

Air Force, Navy, Commercial Airlines, Insurance Companies.

List any conferences, meetings, or trade shows that you and/or industry representatives attend that may help us make contacts to market, commercialize, and learn more about this intellectual property.

NA at this time

Provide a brief (approximately 250 words), non-confidential overview of the invention that may be used to for marketing purposes and to solicit interest from potential licensees and respond to inquiries.

DATeS is a flexible and a highly-extensible testing suite. DATeS is aimed to be a unified testing suite for data assimilation applications where researchers can collaborate, so that it would be much easier to understand and compare different methodologies in different settings. The core of DATeS is implemented in Python to enable for Object-Oriented capabilities. The main functionalities, such as the models, the data assimilation algorithms, the linear algebra solvers, and the time discretization routines are independent of each other, such as to offer maximum flexibility to configure data assimilation applications. DATeS can interface easily with large third party models written in Fortran or C, and with various external solvers. The family of algorithms presented in this work is implemented in DATeS along with standard versions of the traditional data assimilation algorithms.

INTELLECTUAL PROPERTY DISCLOSURE INSTRUCTIONS

Virginia Tech recognizes the value of intellectual property (IP) and is committed to promoting the value of its intellectual property portfolio through its university affiliated corporation, Virginia Tech Intellectual Properties, Inc. (VTIP). Faculty and staff at Virginia Tech have an obligation to disclose research results that may result in intellectual property and/or commercial utilization. The IP disclosure is necessary to enable Virginia Tech to legally protect intellectual property and to comply with government and industry contractual requirements. This is an important legal document that should be completed when something new and useful has been conceived or developed, or when unusual, unexpected or unobvious research results have been achieved and can be utilized.

The **INTELLECTUAL PROPERTY (IP) DISCLOSURE** form is an internal Virginia Tech form used to provide a written record of your intellectual property. The information contained in this disclosure will be used to establish a legal record of the date of conception of the intellectual property, evaluate the technology as to its patent and commercial potential, obtain information necessary to file patent applications or other forms of IP protection, comply with sponsor reporting requirements, and to identify potential licensees.

Virginia Tech is required by federal law to report income along with Social Security numbers for all employees and students to whom compensation is paid. The University may disclose your Social Security number when required by law, or to external entities acting as the University's contractor or agent. Your VT ID number will be used by VTIP to verify your Social Security number.

Please send the completed, signed form and all attachments to **Campus Mail Code 0459**, by email to vtippatents@vtip.org or delivered/mailed to the following address:

Virginia Tech Intellectual Properties, Inc.
2200 Kraft Drive, Suite 1050
Blacksburg, VA 24060

Tel: (540) 951-9374
Fax: (540) 951-5292
Website: www.vtip.org

The completion of this disclosure is the beginning of the inventor's/originator's responsibility in this process. The University encourages all inventors to monitor the progress of their disclosure through VTIP as inventors are often the best sources of information concerning the capabilities and commercial potential of the invention. VTIP has regular office hours on campus and at its location in the Virginia Tech Corporate Research Center to answer your questions and to learn more about the IP and innovation resources at Virginia Tech.

Connect with us:



IP & Innovation Office Hours

@ 3320 Torgersen Hall: Wed & Thur 1 – 5 pm

@ VTIP's CRC Office: Fridays 9 am – 12 pm

DEFINITIONS

Inventorship is determined by criteria specified in the U.S. patent law. U.S. patents are granted only to the true inventor(s). An inventor would be that person who, alone or in combination with others, discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof. Authorship does not mean inventorship.

The correct listing of all inventors is very important. A patent can be invalidated for the failure to list all of the proper inventors. Inventors may need to be added to an application or initially named inventors removed from the patent based upon the final claims in the patent.

Conception according to the U.S. patent law involves the formulation, in the mind of the inventor(s), of a definite and permanent idea of the complete and operative invention. An invention would be complete and operative if the description would enable one of ordinary skill in the art to construct the apparatus or perform the method without extensive research or experimentation. If extensive research or experimentation is necessary to reduce the invention to practice, then the conception was probably not complete. Likewise, if no significant difficulties were encountered and few if any deviations were made from the mental plan, the conception was probably complete, and the person or persons responsible for the plan are the true inventors. If deviations were required, those responsible for the deviations could be joint inventors.

Reduced to practice can be accomplished two different ways. Actual reduction to practice is a physical embodiment of the invention for its intended use. Constructive reduction to practice is reasonable theoretical proof that the invention will work, which is described in writing.

First written publication or oral public disclosure is the first time any member of the general public, without restriction of confidentiality, would have been able to legally gain access to your written or printed enabling description of the invention, or the first oral presentation to the general public.

INTELLECTUAL PROPERTY DISCLOSURE INSTRUCTIONS

TITLE AND DESCRIPTION OF INTELLECTUAL PROPERTY

Provide a descriptive and concise title and attach a **comprehensive description of the invention**. Please state the key features of your invention, its most important uses, and how it improves on existing technology or practice. Attach supporting documentation that can provide a more complete description of the invention (i.e. manuscripts, diagrams, or data) and that describe its advantages and differences over existing technology. In addition, describe the objectives or results to be achieved by this invention.

ORIGINATOR(S)/INVENTOR(S)

- An inventor is a person who has conceived or contributed to an essential element of the invention during the evolution of the technology concept or reduction to practice.
- List originators/inventors in the order you would like them to appear on a patent application or other form of intellectual property protection.
- List all originators/inventors, even if not associated with Virginia Tech. List more than four inventors on an additional page.
- University originators/inventors or contributors listed on Attachment B – Royalty Sharing should keep VTIP informed of any change in address.

RELEVANT SPONSORSHIP AND OTHER AGREEMENTS

Identify and list all grants, contracts, and other sources of funds contributing to or possibly contributing to the conception and/or development of the invention. Accurate and complete sponsorship information is required to meet the obligations of Virginia Tech under sponsored research grants and contracts.

DATES OF CONCEPTION, REDUCTION TO PRACTICE, AND PUBLIC DISCLOSURE

List all dates and provide copies of any publication(s) or abstract(s), oral or written, as well as any proposed publications which mention or describe the invention in whole or in part. Accurate data is essential, as public disclosures affect patent rights in the U.S. and abroad.

Virginia Tech's Policy on Intellectual Property:

<http://www.policies.vt.edu/13000.pdf>

For more information about intellectual property at Virginia Tech:

http://www.research.vt.edu/intellectual_property/index.php