

AIAA Non-Deterministic Approaches Technical Committee Meeting

1400-1530 EST Oct. 13, 2022
Online Zoom Meeting

i. TC officers

- a. NDA TC Chair '21, '22: Vicente Romero
- b. NDA TC Vice Chair '21, '22: Andrew Ollikainen
- c. NDA TC Secretary '21, '22: Ashwin Renganathan
- d. NDA TC Vice Chair '23, '24: Gianluca Geraci

ii. NDA Conference

Tech Chair (Villeneuve, Joshi)

Highlights:

- 2023 NDA Lecture: Daniel Straub (Technical University Munich), January 2023 @ Woodrow Wilson C.
- 2024 Deputy Tech. Chair to be identified/elected this Fall

SciTech 2023 Conference Report

Fall Meeting
13 October 2022

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Conference Planning Timeline

- Call for papers released: 7 March 2022
- Abstract Submission Deadline: 1 June 2022
- Abstract Reviews Completed: 30 June 2022
- Decision Deadline: 13 July 2022
- Sessioning Deadline: 20 July 2022
- Author Notifications: 26 August 2022
- Upcoming Dates to Remember:
 - 31 October: Deadline to request session changes, including switch to virtual.
 - 5 December: Deadline to submit final manuscript and presentation video.*
 - 28 December: Video transcript editing deadline
 - 6 January: Early bird registration
 - 23-27 January: Forum

*ALL presenters - oral-only, virtual, and in-person - must submit a presentation video by Dec 5. It will be used on the virtual platform for virtual attendees, any in-person attendees who couldn't make the session and will be accessible in the video library after the event.



AD&S 2022-2023

	2022						2023			
	Submitted	Rejected	Accept %	Withdrawn	Withdraw %	Scheduled	Submitted	Rejected	Accept %	Scheduled
Adaptive Structures (AS)	48	1	98%	5	11%	42	44	3	93%	41
Design Engineering (DE)	20	4	80%	3	19%	13	24	2	92%	22
Dynamic Specialists	65	1	98%	5	8%	59				
Materials (MAT)	90	21	77%	8	12%	61	107	18	83%	89
MDO	99	7	93%	28	30%	64	116	12	90%	104
NDA	48	4	92%	8	18%	36	39	3	92%	36
Spacecraft Structures (SCS)	41	4	90%	3	8%	34	60	8	87%	52
Structural Dynamics (SD)	83	10	88%	16	22%	57	136	20	85%	116
Structures (STR)	126	3	98%	19	15%	104	139	7	95%	132
Survivability (SUR)	20	8	60%	4	33%	8	7	2	71%	5
System Engineering (SE)	25	0	100%	5	20%	20	31	4	87%	27
Complexity in Aerospace (CASE)							8	1	88%	7
Total	665	63	91%	104	17%	498	711	80	89%	631

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Abstract Submissions

Topic	NDA Papers	Other Papers	Oral Only (Panel)	Total
Aerodynamic Design Under Uncertainty (joint NDA/APA)	1	1		2
Design Under Uncertainty (joint NDA/MDO)	8			8
Mesh Quality, Adaptive Meshing, Error Estimation, and Uncertainty Quantification (joint MVCE/NDA)	0	10		10
Model Calibration, Verification, and Validation	1			1
Model Order Reduction & Surrogate Modeling	11			11
Physics-informed Machine Learning (joint NDA/MDO)	3	3		6
Probabilistic Methods for Structural Health Management	0			0
Reliability and Risk Analysis Methods and Applications	3			3
Uncertainty Analysis Advancements for Wind Energy Applications (joint NDA/WE)	1	2		3
Uncertainty Quantification and Analysis of Complex Aerospace Systems (joint NDA/GNC)	5	3		5
Uncertainty Quantification and Management in Digital Engineering and Digital Twins (joint DGE/NDA)	0	0		0
Uncertainty Quantification and Model Validation for ICME (joint MAT/NDA)	5	5	14	24
Quantifying and Managing Uncertainties in Engineering Systems	2			2
TOTAL	40	24	14	78

13 topics, 8 of which were joint

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After Decisions

➤ Scoring info for NDA submissions

Metric	Value
Min Score	2.6
Max Score	4.73
Median Score	3.63
Average Score	3.68
10th Percentile	3.10
# Rejected Papers	3
Acceptance Rate	93%

➤ Final – 72 contributions

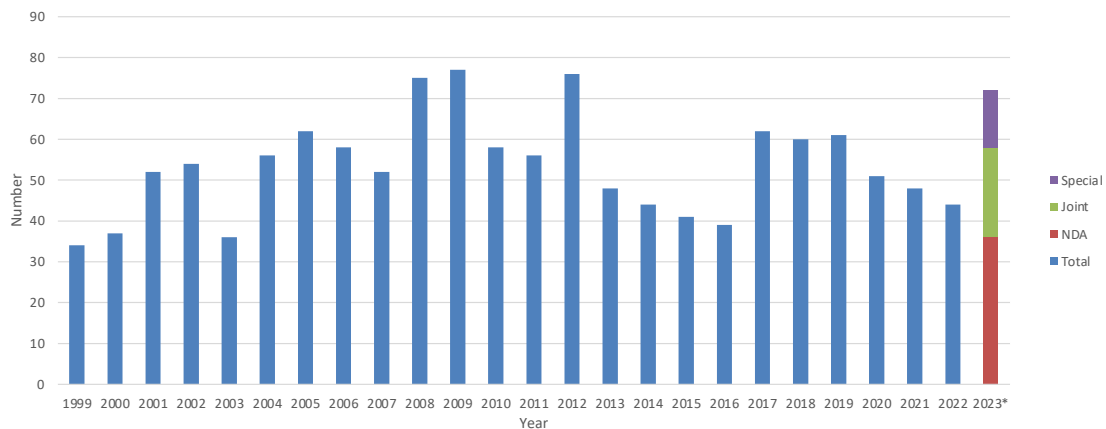
- 36 NDA papers + 22 joint papers + 14 oral-only presentations (ICME panel)
 - Gained papers by including SD in GNC/NDA/SD joint session
 - Moved 1 NDA paper to APA after acceptance
- 17 sessions – 14 in-person, 3 virtual

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NDA Through the Years



For 1999-2022, counts for NDA, Joint, Special (oral-only, etc.) were not available

*2023 does not include withdrawals

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Session Information

SESSION TYPE	SESSION ABBREV	SESSION TITLE	DATE	START TIME	ROOM	SESSION HOST
Technical Lecture	NDA-01	Non-Deterministic Approaches Lecture	23-Jan-23	9:30:00 AM	Woodrow Wilson C	Pankaj Joshi (Chair) Diane Villanueva (Chair)
Technical Panel	MAT-07/NDA-02	Uncertainty Quantification and Model Validation for ICME I	23-Jan-23	4:00:00 PM	Chesapeake 1	Michael Sangid (Chair) Barron Bichon (Chair)
Technical Paper Session	MDO-08/NDA-03	Physics-Informed Machine Learning	23-Jan-23	4:00:00 PM	Chesapeake 6	Ashwin Renganathan (Chair) Felipe Viana (Chair)
Technical Paper Session	NDA-04/MDO-12	Design Under Uncertainty I	24-Jan-23	9:30:00 AM	Chesapeake 3	Anirban Chaudhuri (Chair) Graeme Kennedy (Chair)
Technical Paper Session	NDA-05	Multifidelity Surrogate Modeling	24-Jan-23	2:00:00 PM	Chesapeake 3	Sankaran Mahadevan (Chair) Philip Beran (Chair)
Technical Paper Session (virtual)	MAT-12/NDA-06	Uncertainty Quantification and Model Validation for ICME II	24-Jan-23	4:00:00 PM	Virtual 28	Barron Bichon (Chair) Michael Sangid (Chair)
Technical Paper Session (virtual)	NDA-07/MDO-15	Design Under Uncertainty II	24-Jan-23	4:00:00 PM	Virtual 30	Open Leifur Leifsson (Chair)
Technical Panel	MAT-15/NDA-08	Uncertainty Quantification and Model Validation for ICME III	25-Jan-23	2:00:00 PM	Chesapeake 2	Barron Bichon (Chair) Michael Sangid (Chair)
Technical Paper Session	NDA-09/GNC-30/SD-22	Uncertainty Quantification and Analysis of Complex Aerospace Systems I	25-Jan-23	2:00:00 PM	Chesapeake 8	Xun Huan (Chair) Edwin Forster (Chair)
Technical Paper Session	WE-07/NDA-10	Approaches in Uncertainty Analysis for Wind Energy	25-Jan-23	2:00:00 PM	Chesapeake 10	Anindya Bhaduri (Chair) Alexander Meyer Forsting (Chair)
Technical Paper Session (virtual)	NDA-11	Model Order Reduction and Surrogate Modeling I	25-Jan-23	4:00:00 PM	Virtual 32	Daniel Clark (Chair) Jason Pepin (Chair)
Technical Paper Session	MVCE-05/NDA-12	Adaptive Meshing	26-Jan-23	9:30:00 AM	Chesapeake 8	Steve Karman (Chair)
Technical Paper Session	NDA-13/GNC-36/SD-25	Uncertainty Quantification and Analysis of Complex Aerospace Systems II	26-Jan-23	9:30:00 AM	Chesapeake B	Michael Ross (Chair) Abdessattar Abdelkefi (Chair)
Technical Paper Session	NDA-14	Model Order Reduction and Surrogate Modeling II	26-Jan-23	2:00:00 PM	Chesapeake B	Benjamin Smarslok (Chair) Yongming Liu (Chair)
Technical Paper Session	MVCE-06/NDA-15	Mesh Optimization and Uncertainty Analysis	27-Jan-23	9:30:00 AM	Chesapeake 8	Ryan Glasby (Chair)
Technical Paper Session	NDA-16	Uncertainty Management and Reliability Analysis	27-Jan-23	9:30:00 AM	Chesapeake B	Open Sayan Ghosh (Chair)
Technical Panel	MAT-27/NDA-17	Uncertainty Quantification and Model Validation for ICME IV	27-Jan-23	2:00:00 PM	Chesapeake B	Michael Sangid (Chair) Barron Bichon (Chair)

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Please accept/decline session chair requests ASAP.
If you are available to chair, please let me know.

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NDA Lecture

- **Prof. Daniel Straub**
- **Title:** Towards efficient and safe structures with uncertainty quantification and model-based safety assessments
- **Monday 1/23, 9:30am in Woodrow Wilson C**
- **Bio:** Daniel Straub is professor for engineering risk and reliability analysis at the Technical University of Munich (TUM). His interest is in developing physics-based stochastic models and methods for the decision support and safety analysis of engineering systems, with a particular focus on Bayesian techniques. He and his team at TUM work on fundamental research in uncertainty quantification, safety, reliability and risk assessment as well as decision making under uncertainty. Daniel is also active as a consultant to the industry on reliability and risk assessments, data-driven uncertainty quantification and predictive maintenance. Before joining TUM in 2008, he was a postdoc and adjunct faculty at UC Berkeley and a scientist at ETH Zürich. His awards include the ETH silver medal, the Early Achievement Research Award of IASSAR and the SAE Ralph H. Isbrandt Automotive Safety Engineering Award. He is also an Honorary Professor at the University of Aberdeen, UK.
- **Abstract:** Safety of structures is ensured by conservative design rules and strict inspection and maintenance regimes, which are mainly derived by legacy experience. This safety philosophy has led to high safety levels, and structural failures are now seldomly the root cause for system failures. However, as there is a push towards more resource-efficient systems, further optimization of safety-relevant structural systems must be considered, e.g., by utilizing sensors and monitoring systems. Uncertainty quantification (UQ) and model-based reliability and safety analysis are essential in this process. This talk will present and discuss the use of UQ for assessing and demonstrating safety of structures with sensors and monitoring systems. I will give an overview on the methodology and demonstrate it on selected examples. The talk will also discuss fundamental challenges of model-based safety assessments, including the difficulties associated with selecting proper stochastic models and performing validation.



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Student Paper Competition Chair (Geraci and Bhaduri)

Highlights:

- Call for SPC judges – review activity Dec 6 – Jan 2. Please reach out to Gianluca and/or Anindya.

NDA SPC Chair Notes

Gianluca Geraci (NDA SPC Chair) and Anindya Bhaduri (NDA SPC Deputy Chair)

- 6 NDA Student Paper submissions in the initial screening
- 2 judges reviewed each manuscript
- All six contributions advanced to the semi-final round
- 58 semi-finalists across all TCs
- **SPC Manuscript Deadline:** Student manuscripts must be uploaded to the manuscript submission website **by December 5 2022** (same as regular paper, NO EXTENSIONS allowed)
 - Students who **miss this deadline will be removed** from the student paper competition
 - Paper **revisions** will be due on January 2
 - Each paper reviewed by 3 TC-specific judges and 1 cross-TC judge
 - 15 finalists will be selected
 - Final rounds will take place during the conference (scheduled on Mon, Tue, Wed)

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NDA SPC Chair Notes

- Call for volunteers of SPC paper judges
 - We will reach out for help, but please contact us if you have time to judge 4-8 manuscripts (Dec 6th -Jan 2nd)
 - Any help is very much appreciated!
- No judging rubric yet, likely same from last year.

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ADSG SPC (Rumpfkief)

ADSG SPC23 – 58 submissions total, paper judging (due date Jan 2nd), 5 papers per judge, 4-5 judges required (please reach out to Markus). Dec 5 deadline--Dec 6 handed out, and due Jan 2nd. Papers are eligible for awards within NDA as well as conference wide awards.

iii. Subcommittee Updates/Reports

Membership (Ollikainen)

Fall 2022 NDATC Membership Subcommittee

- 47 of 50 Total Members
 - 23 Academia
 - 15 Government
 - 9 Industry
- Experience (Opportunities for collaboration and mentoring)
 - 4 Fellows
 - 14 Associate Fellows
 - 12 Senior Members
 - 9 Members
 - 4 Young Professionals
- 5 new members since Spring 2022 meeting:
 - Anindya Bhaduri, PhD GE Global Research
 - Sifeng Bi, PhD Univ. of Strathclyde, Scotland
 - Patrick Blonigan, PhD Sandia Livermore
 - Dushhyanth Rajaram, PhD Georgia Institute of Technology
 - Humberto Silva, PhD Sandia Albuquerque
- Administration Items
 - 4 members are behind on AIAA membership—please check status
 - 20% of TC have pictures posted on ENGAGE—help our new members to get to know you

Awards (Choi)

AIAA NDA Best Paper Award

ASME CIE Conference (4 TCs: AMS, CAPPD, SEIKM, VES)

Step 1: Symposium organizers (Session Chairs/co-Chairs)

- 2~3 Review Reports are available on each submission
- Symposium organizers identify candidates for the best paper award based on the review reports. Then, recommend 1~2 papers to the TC chair

Step 2: ASME TC

- TC Committee (Chair/Vice Chair/Secretary) collects recommendations and reviews the reports
- TC Committee makes a vote and sends a short list (2 papers) to CIE Executive Committee

Step 3: CIE Executive Committee

- CIE Executive Committee selects CIE's best paper award and finalizes the best paper awards for each TC.

AIAA NDA Best Paper Award Process (???)

Step 1: NDA TC Chair asks session chairs/co-chairs to select 1 paper per session.

- Session chairs send 1 paper (pdf file) to NDA award sub-committee Chair

Step 2: Award committee chair remove the authors' names from the pdf files.

- Award sub-committee reviews the recommendations and conducts a survey.
- NDA award sub-committee chair recommends 2 papers to NDA TC Chair.

Step 3: NDA TC Committee selects the NDA best paper award.

Education (Gorodetsky)

Highlights:

- A review-paper like effort is planned on incorporating NDA into undergraduate curriculum. Interested folks may reach out to goroda@umich.edu.

AIAA NDA TC Meeting

Updates from Education Subcommittee

October 13, 2022
Alex Gorodetsky

Education Subcommittee

Mission

- Seek and support educational activities such as short courses and colloquia related to the TC's area of expertise.
- Provide organizational leadership for larger volumes of work. May invite chapters from TC members.
- Support furthering education at colleges and universities through liaison with the academic community and by helping to incorporate NDA concepts into university curricula through advocacy and development of teaching modules.

Current Members 2022:

- Dr. David Moens
- Dr. Alex Gorodetsky
- Dr. Sameer Mulani
- Dr. Boris Kramer (Lead 2021-2022)
- Dr. Yongming Liu
- Dr. Jay Martin (Lead 2020-2021)
- Dr. Gianluca Iaccarino
- Dr. Sankaran Mahadevan
- Dr. Qiqi Wang
- Dr. Harok Bae
- Dr. Yiming Zhang
- Dr. Vassili Toropov

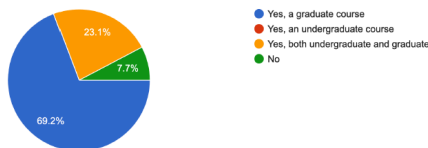
Goals and objectives for 2022-2023

- Analyze survey (included here if interested)
 - Last year we collected a survey on NDA educational offerings
- AIAA Guest speaker at universities
 - Awareness of these topics and the NDA TC
 - Is anyone interested from the NDA TC to engage in a distinguished speaker series?
 - <https://www.aiaa.org/get-involved/regions-sections/distinguished-Distinguished-Speaker-Series>
- Undergraduate focused seminar at AIAA Scitech
 - Is there interest to organize a pedagogical focused seminar/minisymposium at AIAA Scitech?
 - Either undergraduate education in NDA, or
 - Informational for undergrads about what NDA is
- Lower the barrier to entry for incorporating NDA information for professors teaching undergrad classes in classical areas (aerodynamics, structures, controls)
 - Provide materials for 1-2 classes that can help introduce this
 - Maybe SIAM or AIAA type review paper targeting educational aspects
 - Interested folks should email me goroda@umich.edu

Survey Results 1

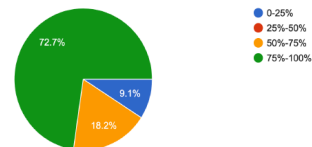
Is there a course offered (somewhat regularly) at your school that covers non-deterministic engineering approaches? (E.g., Uncertainty quantifi...y, stochastic approaches, inverse problems, etc..)

13 responses



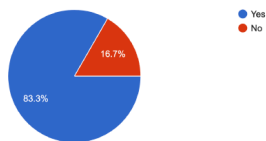
How much of that course is on non-deterministic methods?

11 responses



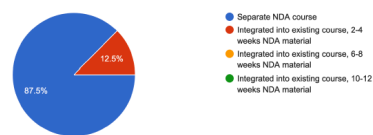
If there is no NDA course offered at your institution, would you be in favor of an NDA course to be offered at your university?

6 responses



Would you prefer this to be a separate NDA course? Or would it be sufficient to add some NDA content to an existing course?

8 responses



iv. Liaison Reports

- AIAA Structures TC (?)
- AIAA MDO TC (Vassili Toropov)
- AIAA Materials TC (Barron Bichon)
- AIAA Design TC (Phil Beran)
- AIAA Applied Aero TC (Eric Walker)
- AIAA Fluids TC (Gianluca Iaccarino)

- g. ASCE (Sankaran Mahadevan)
- h. ASME (Ben Thacker)
- i. ISSMO (Nam-Ho Kim)
- j. SAE (?)
- k. SIAM UQ (Ben Smarslok, Xun Huan)

v. Roll call (use Zoom attendance record)

Andrew Ollikainen
Call-Out User_1
RAMANA GRANDHI
Alex Arkady Gorodetsky
Dan Clark (AFRL) (Dan Clark)
Barron Bichon (SwRI)
Diane Villanueva
Seung-Kyum Choi
Zhen Hu
Sameer Mulani
Jason Pepin
Erin DeCarlo (SwRI)
Patrick Blonigan
Ashwin Renganathan
Masoud Rais-Rohani
Markus Rumpfkeil
Anirban Chaudhuri
Ed F.
Ryan Jacobs
Xun Huan
Greg Roth (AFRL/RQ)
Sayan Ghosh
Ed F.
Pankaj Joshi
Sifeng Bi

vi. Other Items

- a. Discussion: new catch-phrase for NDA? (Romero)
 “Non-deterministic approaches and uncertainty quantification provide a

connecting bridge between the real world and the virtual world of math, models, and computer simulations.”

Current from TC Manual—too technical for general audiences?

“Non-Deterministic Approaches encapsulate all methods, philosophies and approaches that seek to address the effect of inherent and systematic uncertainties in engineered systems.”

- vii. Next Meeting – **SciTech2023 Zoom and In-Person, Wed. Jan. 25, 1900-2200 EST**