

AIAA SCITECH 2019
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scitech.aiaa.org

Atmospheric Flight Mechanics Technical Committee

The AIAA Atmospheric Flight Mechanics (AFM) Conference provides a forum for presentation and discussion of all technical areas related to atmospheric flight. It brings together experts from industry, government, and academia on an international level. Presentations will cover the topics of aircraft dynamics, unsteady and high-angle-of-attack aerodynamics, flying and handling qualities, system identification, aerospace vehicle flight testing, projectile and missile dynamics, UAVs, expendable and reusable launch vehicles, and reentry and aero assist vehicles. These technical sessions consist of formal presentations followed by an informal discussion. They are intended to serve as a platform to bring together experts and interested people, not only to discuss technical aspects, but also to cultivate professional relationships.

Technical Areas

Technical papers discussing any and all areas of interest in atmospheric flight are solicited for the AIAA AFM Conference. Student papers are also eligible for the Best Student Paper Competition. Papers are invited that address new findings and/or innovative approaches in computational, experimental, or theoretical development; flight testing; research and development; or simulation results. Areas of interest for this conference include, but are not limited to: aerodynamic performance; trajectories, attitude dynamics, and evaluation of conventional aircraft as well as vehicles of unusual configurations, including unmanned systems and unmanned combat aerial vehicles (UCAV), expendable and reusable launch vehicles (ELV/RLV), and short takeoff vertical landing vehicles (STOVL); hypersonic platforms; flying qualities and aircraft-pilot coupling phenomena; missiles; spacecraft; reentry vehicles and vehicles moving through a planetary atmosphere; response to atmospheric disturbances; and bio-inspired flight mechanics. In addition, papers are encouraged that deal with education and design in the field of atmospheric flight mechanics, multidisciplinary efforts, and international collaboration projects. The areas of interest above will be organized into the following topics.

- **UAVs and Unmanned Systems**—All aspects of UAVs, particularly those addressing innovative control effectors, operator interface flying qualities throughout the flight envelope, trajectory and flight path optimization, flight test results, and related subjects.
- **Aircraft Dynamics**—Interaction between aerodynamics and aircraft motion across the flight spectrum (subsonic, transonic, supersonic, and hypersonic). Subtopics include: effects of configuration changes on aircraft stability, control, and air data systems; store separation; determination of stability and control derivatives and analysis; departure prevention and spin characteristics; effects of aeroservoelasticity on flight dynamics, atmospheric disturbance response and control of such disturbances; trajectory optimization; and flow-field effects. All airframe types, from general aviation to trans-atmospheric, are appropriate topics for consideration.
- **Aircraft Flying Qualities**—Flying and handling qualities of aircraft. Topics of interest include aircraft-pilot coupling phenomena, controllers with associated aerodynamic and feel characteristics, displays with associated lag characteristics/placement/adequacy, and pilot-vehicle interface in general. Because pilot opinion is the final determination of flying qualities, papers are sought on the design of specific simulation and flight test maneuvers for flying-qualities evaluation. Other topics include: development and validation of criteria; design tools and procedures to satisfy criteria; techniques to analyze and verify compliance

on highly augmented and highly maneuverable aircraft; flying qualities of UAVs, UCAVs, and micro-UAVs; and flying qualities of STOVL aircraft transitioning between powered flight and wing-borne flight and flying qualities guidelines for STOVL mode flight.

- **Projectile and Missile Dynamics and Aerodynamics**—Dynamics and aerodynamics of missiles and projectiles, both powered and unpowered. Subtopics include: bodies with circular and noncircular cross sections; roll-stabilized and spin-stabilized missiles and projectiles; the application of computational methodologies to the prediction of aerodynamic characteristics, especially roll-coupling and high-angle-of-attack effects; launch dynamics of both surface- and air-launched missiles; measurement, numerical computation, and estimation of dynamic stability and control derivatives; incorporation of analysis, experimental results, and computational predictions into six degree-of-freedom trajectory simulations; and analysis of flight test data.
- **System Identification and Parameter Estimation**—Papers are desired on techniques for extracting aerodynamic data from flight-test, dynamic wind tunnel, or free flight model experiments. Topics of interest include: modeling of nonlinear or time-dependent aerodynamic effects; techniques of model structure determination; the effects of active controls; incorporation of results into simulation and analysis databases; vehicle flexibility; techniques for the high- angle-of-attack flight regime; flight path reconstruction techniques; estimation of air data and flow-field parameters; identifiability issues; experiment design; and results obtained for conventional as well as new or unusual vehicle configurations.
- **Reentry and Aeroassist Vehicle Technology**—Dynamics of entry into the Earth's or other planetary bodies' atmospheres. Subtopics include computational aerothermodynamics, aero assist orbit transfer vehicles, tethered satellite applications, technology concerning development of high L/D vehicles, hypervelocity and impact technology, trajectory optimization, maneuvering of reentry vehicles, ablation and erosion effects, and low density atmospheric flight mechanics.
- **Launch Vehicles and Launch Abort Vehicles/Systems**—Flight dynamics throughout the flight envelope, modeling for flight prediction, trajectory optimization, management of flexible and rigid body modes, requirements for human spaceflight, innovative design concepts, and reusability.
- **Unsteady and High Angle-of-Attack Aerodynamics**—Aerodynamic characteristics of aircraft and missiles operating in a nontraditional part of the flight envelope (e.g., high angles-of-attack or sideslip, large angular rates). Of particular interest are unsteady and nonlinear aerodynamic characteristics, concepts for improved aerodynamic control effectiveness, dynamic lift and super-maneuverability, symmetric and asymmetric vortex wake structures, vortex breakdown, computational fluid dynamics techniques applicable to vortical and separated flows, and math modeling approaches to represent the dynamic characteristics in simulation studies.
- **Linear and Nonlinear Equations of Motion**—Classes of ordinary differential equations; nominal and perturbation solutions; axis systems, Euler angles, rotations, and transformations; integration of nonlinear differential equations; stability and control derivatives; unsteady aerodynamic effects; separation of equations into longitudinal and lateral-directional sets; and numerically implemented qualitative methods, their applications, and the results of these applications.
- **Atmospheric Flight Mechanics Education**—Papers are sought from industry, government agencies, and universities that deal with all aspects of atmospheric flight mechanics education at both undergraduate and graduate levels in aerospace engineering

curricula. Topics include: the needs of industry and government agencies; support needed to advance the state of the art; techniques for keeping up with the fast pace of research, especially at the undergraduate level; and innovative and realistic approaches to education.

- **Vehicle Flight Test**—All aspects of testing atmospheric and exospheric flight vehicles, particularly as they pertain to the vehicle flight mechanics, are of interest. Topics of interest include: flight evaluation of novel control systems or vehicle configurations; development and implementation of new maneuvers, methods, or tools for testing that provide new insight into flight mechanics; presentation of data analysis and testing results for important or unique vehicles; and modeling and simulation techniques used in support of flight test.
- **Bio-Inspired Flight Mechanics**—Flight mechanics of bio-inspired flight technologies and concepts, such as micro and nano air vehicles. Such vehicles present unique technological challenges on multiple levels including aerodynamics, performance, mission endurance, sensors, and flight GN&C. Topics of interest include flight mechanics of birds, insects, and bio-inspired air vehicles; and modeling of coupled unsteady aerodynamics and flight dynamics for maneuvers such as flapping, hovering, and perching.

Invited Sessions and Workshops

Invited sessions and workshops are solicited in any of the areas listed above as well as in related and new or emerging technical areas. Such an invited session or workshop should form a cohesive focus on the particular topic. It will be the job of the invited session/workshop organizer to contact and confirm the expert speakers in advance. Any potential invited session/workshop organizer should contact the Technical Program Chairs well in advance of the submittal deadline for approval.

Workshops may be conducted on an informal basis and limited to presentations without written manuscripts, if deemed appropriate by the organizer. Potential workshop organizer should provide the Technical Program Chairs with a short description of the topic with a list of expected presentations that could be expanded subsequently.

Invited sessions are expected to follow the usual procedure of draft manuscript submittal and presentation. These papers will be published in the conference proceedings. The submission procedure is, however, slightly different from the normal paper submission. **Authors will submit all appropriate information to the invited session organizer, and the organizer will then submit the entire session electronically to the invited session area.** The session package must contain 200- to 300-word abstracts of the papers, and each author's name, affiliation, address, phone number, and e-mail address.

Please note that incorporation of the proposed Invited Session and Workshop at the AIAA SCITECH 2019 Forum will be at the discretion of the Technical Program Chairs. Furthermore, in consultation with the prospective organizer, individual papers may be removed from the proposed invited session and/or put in the regular session. Likewise, normal contributed papers may be put in the invited session.

Atmospheric Flight Mechanics Student Paper Competition

The AIAA Atmospheric Flight Mechanics Technical Committee, with the support of Calspan Corporation (www.calspan.com), is sponsoring a Best Student Paper Competition at the 2019 AIAA SciTech Forum. Entrants will be judged by Technical Committee members, and the winner will receive a certificate and \$500 award. To be eligible for this award, the student must be the primary author of the paper, and the work must have been performed while the author was a student. Students will present their papers in the relevant conference technical sessions with judges in attendance.

The scoring for the award will be equally based on written paper content and oral presentation. The written paper will be judged on: 1) relevance of the topic to atmospheric flight mechanics; 2) organization and clarity; 3) appreciation of the technical issues and sources of errors; and 4) meaningful conclusions of the research. The oral presentation will be judged for overall clarity, including: 1) background and problem definition statement; 2) explanation of technical approach; and 3) explanation of research results.

Note, in order to be considered for the competition, that entrants are encouraged to choose the student paper competition option when submitting their papers on the AIAA conference submission system, currently managed by ScholarOne. Usually this involves choosing the paper as a “Student Technical Paper” instead of “Technical Paper” in the submission category. The paper will still be treated as a technical paper and will appear in sessions with other appropriate non-student papers if selected. However, marking the paper as a “Student Technical Paper” allows the conference organizers to also assess the paper for the additional review.

For inquiries regarding the Atmospheric Flight Mechanics Student Paper Competition, please contact **Michael Grant** (migrant@purdue.edu) or the Technical Chairs listed below.

Draft Manuscript Submission Guidelines for AFM Conference

Paper selection for this conference will be based on a full-length draft manuscript of the proposed technical paper. Drafts of proposed papers must be unclassified and not exceed a length of 36 standard-size, double-spaced, typed pages (including equations, figures, and tables), where each normal-sized figure counts as one page. Each draft must begin with a 100- to 200-word abstract, and an introduction that includes a brief assessment of prior work by others and an explanation of the paper’s main contributions. The body of the manuscript must include sufficient detail to allow an informed evaluation of the paper. At a reduced chance of acceptance, in lieu of the full-length draft manuscript, authors can submit an extended abstract of at least 1500 words that includes major results of the work backed by illustrative figures. A few succinct data figures that clearly show actual results are mandatory. Submissions not meeting the above criteria will not be considered for acceptance.

Please direct questions to the Atmospheric Flight Mechanics Technical Chairs:

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