

Requirement for all Positions: US Citizen or Green-card Holder graduated with PhD in engineering in last 3 years. This position will be hosted by Advanced Dynamics and jointly supported by Advanced Dynamics and NSF. Interesting candidates, please directly apply online at <https://aseensfip.asee.org/apply/sessions/new> when you see this advertisement because we only have limited number of positions available. When you get onto the website, please look into the position associated with Advanced Dynamics and apply. After you complete application, please forward your application as well to Patrick.g.hu@AdvancedDynamics-USA.Com

Compensation and Employment Term: You will get annual compensation of 75K as stipend and health insurance. Initial appointment is 1 year, with a possibility of renew of additional 1 year but depending the funding availability and performance.

Position 1: Postdoc Position in Mesh Generation and Visualization for CFD and FEA

High quality mesh generation is very important for computational fluid dynamics (CFD) and finite element analysis (FEA). Various Mesh generation methods have been developed in last decades and have become daily exercise of CAE engineer. However, automatic grid generation with little human interaction is still a research topic and needs to be developed. Advanced Dynamics Corporation is currently developing the world's leading software in CFD and FEA and is dedicated to the development of the software tool for automatic mesh generation. Thus, this posdoc position will focus on the development of highly efficient mesh generation algorithms and relevant code implementation as well as integration.

Required: working knowledge in mesh generation, professional in C/C++/Java, familiar with visualization tool kit (VTK) and Tcl/tk or Paython;

Position 2: Postdoc Position of CFD for Fluid-structure Interaction of Biofluids Interacting with Tissues.

Advanced Dynamics is developing novel CFD approaches for fluid-structure interactions of biofluids interacting with tissues (i.e. blood interacting with heart tissues and air flow interacting with lungs) to provide the insight for physicians. This computational technology plays increasingly important role in diagnosing the causes of the associated problems for patients. We approach the problems by using meshless particle methods or Cartesian based CFD solvers that are more computational efficient and accurate.

The postdoc would focus on the development of numerical algorithms and code implementations of the particle-based and Cartesian CFD solvers and conduct the actual modeling and simulations for fluid-structure interactions of biofluids with tissues. The modeling and simulation results will be provided to Doctors for diagnosing the actual causes of the patients's problems in hospitals and research institutions.

Required Skills: Working knowledge of CFD algorithms and programming languages such as Fortran, C/C++, more knowledge of particles-based CFD solvers and Cartesian solver is plus, but not required. Knowledge of biology is not required.

3. PostDoc Position in Flight Control and Dynamics

Advanced Dynamics is developing novel CAE software for analysis and design optimization of aircraft, the flight control and dynamics module is a key component/module of this software. Advanced Dynamics would like to hire 1 postDocs in this field to develop the flight control law algorithms and software. The main purpose of this control module include flight control law design such as PID, H_{∞} , H_2 , adaptive control and control law allocations, etc. When combined with computational fluid dynamics (CFD), it can be used for flutter/LCO/gust suppression.

The postdoc would focus on the development of control law algorithms and code implementations of the relevant control laws. When combined with CFD/CSD module, the candidate should be able to conduct the modeling the elastic aircraft for flutter/LCO/gust prediction and suppression.

Required: working knowledge of various control law design such as PID, H_{∞} , H_2 , LQR, adaptive control, etc in aircraft flight control and dynamics, CFD knowledge is plus, but not required. Professional in programming languages of Fortran, C/C++, matlab, etc.

4. PostDoc Position in Cartesian-based CFD Solvers

Advanced Dynamics is currently developing Cartesian-based CFD solver and would like to hire a PostDoc in the field. The Cartesian based CFD solver is much more computational efficient and accurate than traditional structured and unstructured CFD solvers, particularly in simulation and modeling of moving body problems. Advanced Dynamics approach such a problem by using dual-mesh and meshless methods around the body.

The postdoc would focus on the development of numerical algorithms and code implementations of this Cartesian-based CFD solver and conduct the actual modeling and simulations for the moving body CFD problems such a store separation.

Required Skills: working knowledge of Cartesian-based CFD algorithms and programming languages such as Fortran, C/C++.

5. PostDoc Position in Numerical and Software Development for Boundary Layer Transition

For studying boundary-layer transition phenomena, a variety of theoretical and computational tools have been developed in the last few decades. These tools include the following: linear stability theory, secondary instability theory(SIT), parabolized stability equations(PSE), large eddy simulation(LES), and direct numerical simulation(DNS). They are listed in order of

increasing computational requirements, and the fourth and the fifth of these methods are still in the early stages of development. For an economical and revealing study of each stage in a comprehensive investigation of a complete transition process from laminar to turbulence, we see the appropriate role for these approaches to be as follows: LST should be used to select the most important primary instability waves and, thereby, to determine the relevant streamwise scales of the instability waves. SIT disclosed the most important secondary instabilities and serves largely to determine the relevant scales in the spanwise direction. The PSE approach uses LST and SIT as a guide and provides a tool for conducting relatively inexpensive spatial simulations of the primary, secondary, and early nonlinear stages of transition. LES and DNS builds upon the results of SIT and the PSE approach and are most appropriate for simulations of the strongly nonlinear stages of transition. However, LES and DNS are extremely expensive especially for very high Reynolds number flow and are impractical to be used in the fast design cycle of the flight vehicle.

The Postdoc would focus on developing a fast and accurate transition prediction approaches and implement it into computational efficient software for design of planetary entry vehicle.

Required Skills: The knowledge of hypersonic aerodynamics, real gas thermodynamics, flow instability and transition, etc. Professional in programming languages such as Fortran, C/C++.

6. PostDoc Position in Large-eddy Simulation for Jet Noise Prediction and Control

Among several existing turbulence models, large-eddy simulations (LES) offers the most promise in the foreseeable future for noise prediction at Reynolds numbers of practical interest. The proper choice of a good SGS model is the key issue for accurate jet noise prediction using LES. Accurate SGS modeling will be required to improve the prediction and understanding of turbulent mixing for accurate jet noise prediction. Although previous studies have investigated this issue, no clear conclusion has been reached.

The most common closure strategy is based on the Smagorinsky eddy viscosity model, a dynamic procedure for computing the model coefficient from the resolved velocity field, which represented a major improvement in the robustness and accuracy of LES. Other popular SGS models include the scale similarity model, approximate deconvolution model (ADM), the stretched vortex model (SVM), and monotonically integrated large eddy simulation (MILES).

LES based computational aeroacoustics studies of complex geometries such as nozzles, chevrons is necessary to extend its application to study jet noise control. Multiblock approach, in which the computational domain is decomposed into several blocks, is often pursued. Accurate interface boundary conditions are necessary for accurate communication process between the adjacent blocks.

This PostDoc research will focus on developing accurate SGS models that can accurately capture the complex phenomena of hot supersonic jets including turbulent jet mixing, shock-turbulence

interaction. In addition, LES solver will be developed to simulate flow in complex geometries to extend the study to jet noise control.

Skills Required: Strong background in the areas of fluid mechanics, thermodynamics; Expertise in the areas of computational aeroacoustics, large-eddy simulations; Numerical programming including parallel programming of FORTRAN and C++/C.

7. PostDoc Position in Innovative Modeling and Simulation Tool for Fatigue Crack Growth of Airframes

Advanced Dynamics is currently developing an innovative modeling and simulation tool for fatigue crack growth of airframes. An innovative modeling and simulation for fatigue crack growth and methodology of remaining life prediction of aircraft structures is highly demanded for safely operating civil as well as military aircrafts. The direct application of this effort to the current needs of US aerospace industries is significant and the improvement of physics-based identification, modeling and simulation, and life prediction of aircraft structures against fatigue crack initiation and propagation is a common interest for wide range of engineering applications. The methodologies that Advanced Dynamics takes will have great potential for enhancing the methodology of life prediction of aging aircraft against fatigue. DoD components likely to have interests in the technology developed in this effort are the US Air Force, Navy and Army. The US industrial companies, including various aerospace & ocean as well as general engineering companies such as Boeing, Pratt & Whitney, General Electric, General Dynamics, Lockheed Martin and Textron, will be the major non-military potential customers.

The postdoc would focus on the research and development of efficient and accurate numerical algorithms for modeling and simulation tool for fatigue crack growth of airframes. The resulting technologies will be implemented into a computational efficient software code for actual analysis and design of modern aircraft.

Strong background in the areas of structural mechanics, CFD knowledge is plus, but not required; Expertise in the areas of fatigue and cracks; Professional with both programming languages of FORTRAN, C/C++.

8. PostDoc Position in Multifunctional Drug Delivery for Cancer Theranostics

Nanoscale devices carrying therapeutic payloads and delivered within close proximity of the tumor in vivo can play a significant role in increasing the effectiveness of the treatment while decreasing severity of side effects. Multifunctional nanoscale devices allow for a combination of diagnostic agent with a therapeutic and even a reporter of therapeutic efficacy in the same nanodevice package. The theranostic nanodevice we used will hold considerable promise to achieve personalized therapy of cancer and to maximize the specificity and efficacy of chemotherapy. SPMN nanodevice as the end products of this project will have huge market potential for cancer treatments and have tremendous impacts.

Required individuals with the following background: The successful applicant will join a multidisciplinary team that is involved in utilization of nanoparticles as a drug delivery carrier

and imaging detection. Responsibilities will include synthesis of polymeric/inorganic nanoparticles incorporating various drugs/imaging probes and their characterization by using TEM, DLS, SEM etc. A Ph.D. in chemistry engineering, biochemistry engineering or relevant area is required. Previous experience involving nanoparticles synthesis and characterization is required; basic knowledge in biology is desired.